DISSERTATION

FOR THE AWARD OF DEGREE

MASTER OF SCIENCE

SESSION 2022-2025

Impact of Guided Mantra Meditation and Yoga Asanas on Pulmonary Function, Sleep Quality and Stress level in Young Adults with Mild Sleep Disturbances

MSc. Medical Physiology

Submitted By

Gauri Mudgal

Batch (2022-2025)

DEPARTMENT OF PHYSIOLOGY

SANTOSH DEEMED TO BE UNIVERSITY

NO. 1, SANTOSH NAGAR, GHAZIABAD-201009,

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DECLARATION OF CANDIDATE

I hereby declare that this dissertation title **Impact of Guided Mantra Meditation and Yoga Asanas on Pulmonary Function, Sleep Quality and Stress level in Young Adults with Mild Sleep Disturbances** is a bonafide genuine research work carried out by me under the esteemed guidance of my Guide **Dr. Manisha Gupta** Department of Physiology, Santosh Deemed to be University, Ghaziabad, (U.P)

Signature of Candidate

Date:

Place:

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CERTIFICATE BY THE GUIDE

This is to certify that the dissertation title **Impact of Guided Mantra Meditation and Yoga Asanas on Pulmonary Function, Sleep Quality and Stress level in Young Adults with Mild Sleep Disturbances** is a bonafide geniune research work carried out by **Gauri Mudgal** is partial fulfillment of the requirement for the degree of **M.Sc in Medical Physiology** under my supervision and guidance in department of Physiology, Santosh Deemed to be University, Ghaziabad, (U.P)

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ENDORSEMENT BY DEAN ACADEMICS OF THE UNIVERSITY

this is to certify that the dissertation title **Impact of Guided Mantra Meditation and Yoga Asanas on Pulmonary Function, Sleep Quality and Stress level in Young Adults with Mild Sleep Disturbances** is a bonafide genuine research work carried out by **Gauri Mudgal** himself under the esteemed guidance of **Dr. Shalabh Gupta** ,Santosh Deemed to be University, Ghaziabad, (U.P)

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INTRODUCTION

In modern society, where daily life is dominated by demanding schedules and urbanized routines, young adults are increasingly affected by stress, sleep irregularities, and respiratory challenges. These issues have been amplified by lifestyle patterns characterized by prolonged screen exposure, minimal physical activity, particularly in the aftermath of the COVID-19 pandemic [1], and inconsistent daily habits influenced by work pressure and social demands. Such factors collectively predispose individuals to a broad spectrum of health concerns. Initially, these may appear as minor disturbances but can progressively escalate into chronic conditions, including sustained psychological stress, sleep disorders, anxiety, and compromised pulmonary as well as mental health.

Stress can be described as a state of elevated emotional and physiological tension that often manifests through anxiety, irritability, low mood, mental fatigue, or fear. While mild stress may enhance focus and motivation, persistent or excessive stress is strongly associated with detrimental effects on both mental and physical well-being. Recent survey findings from the Worldwide Independent Network (2023–2024) reveal that approximately four out of five individuals experience high levels of stress, whereas only a minority report infrequent or negligible stress exposure. The burden is particularly evident among students (83%) and full-time employees (82%), highlighting the profound influence of modern lifestyle pressures. Young adults are frequently exposed to stress-provoking scenarios arising from academic responsibilities, professional commitments, family obligations, and financial challenges [2].

Sleep is an essential physiological function that ensures homeostasis and overall health. For optimal cognitive and physical performance, adults are generally recommended to obtain 7–8 hours of sleep per night. Epidemiological studies indicate that nearly one-third to almost half of older adults suffer from some form of insomnia, with common

disturbances including poor sleep quality, obstructive sleep apnea, and episodes of daytime drowsiness [3,4].

Among young adults, sleep problems are widespread and frequently manifest as insomnia, shortened sleep duration (less than 7 hours), recurrent awakenings, and impairments in mood or cognition, such as irritability, poor concentration, and low motivation. These disturbances have downstream effects on cardiovascular health, stress levels, and overall well-being. Insomnia, a term encompassing difficulties with sleep initiation, maintenance, or early morning awakenings, results in fatigue, low energy, and non-restorative sleep, all of which negatively influence mental health [5,6]. Notably, the prevalence of these sleep difficulties is higher in young adults than in older individuals, reflecting the greater susceptibility of this age group to lifestyle-driven sleep disruptions.

Respiratory disorders negatively affect both pulmonary function and quality of life. Chronic conditions, such as chronic obstructive pulmonary disease (COPD) and idiopathic pulmonary fibrosis (IPF), compromise gas exchange through progressive damage to alveolar structures, ultimately diminishing lung efficiency [7]. Globally, lung diseases are among the leading causes of mortality, with COPD accounting for millions of deaths annually. Tobacco consumption and active smoking remain the predominant risk factors for its onset. Even in young adults, impaired lung function can reduce exercise tolerance and overall fitness. Conversely, regular physical activity is strongly linked to the maintenance of optimal lung capacity, independent of age and lifestyle variables. Individuals who are physically active often demonstrate higher values of forced expiratory volume in one second (FEV1) and forced vital capacity (FVC) [8].

Yoga has a well-recognized impact on both stress and sleep regulation. As an ancient mind-body discipline, yoga exerts multidimensional benefits on human physiology,

including autonomic balance and improved mental health. Consistent practice enhances parasympathetic activity, leading to reductions in heart rate, blood pressure, and circulating stress hormones, while also relieving muscular tension. These physiological changes foster a sense of mental calmness, which, in turn, facilitates deeper and more restorative sleep. Individuals who engage in daily yoga routines often experience longer periods of slow-wave sleep and fewer nocturnal awakenings, ultimately improving the consolidation and quality of sleep [9,10].

Yoga contributes significantly to improving mental health in young adults by fostering self-awareness, emotional stability, and cognitive clarity. Regular practice reduces anxiety, alleviates intrusive thoughts, and strengthens psychological resilience, thereby enhancing overall well-being [11]. Yoga practice is also associated with beneficial neuroendocrine modulation, including a decline in cortisol levels and a rise in melatonin secretion, both of which play crucial roles in stress regulation and sleep quality [12].

Meditation, an integral component of yogic practice, exerts a profound influence on sleep architecture. It accelerates sleep onset by reducing beta-wave activity, which is linked to heightened cognitive engagement, while simultaneously enhancing alpha and theta wave patterns that promote relaxation and restorative sleep [13]. This neurophysiological shift prolongs deep sleep stages, which are vital for mental and physical rejuvenation. Meditation also shortens sleep onset latency (SOL), reduces nighttime awakenings, and enhances daily concentration and mindful energy. Moreover, these practices can mitigate academic stress, discourage pre-sleep screen exposure, and help stabilize irregular daily routines, thereby further improving sleep quality and cognitive efficiency [14].

Engaging in regular yoga practice harmonizes the body, mind, and breath, producing structural, physiological, and psychological benefits for practitioners. Its effectiveness in

stress management is well-established across the scientific literature [15,16]. Beyond mental health, empirical studies highlight yoga's favorable impact on cardiovascular, respiratory, and metabolic functions. Most existing research, however, has focused on the outcomes of prolonged and consistent practice. The influence of short-term yoga engagement on autonomic regulation and metabolic parameters still requires additional exploration.

To address this gap, the present interventional study was designed to evaluate the impact of short-term yoga practice on healthy young adults. The study focuses on its effects on cardiovascular performance, pulmonary function, body mass index (BMI), blood glucose levels, lipid profiles, and thyroid function [17]. Through this investigation, the aim is to determine whether even limited exposure to structured yoga practice can induce measurable physiological benefits.

Stress plays a central role in the onset and progression of numerous health concerns, including anxiety, depression, emotional dysregulation, and even suicidal tendencies. Depression is typically marked by a persistent low mood, diminished interest in daily activities, fatigue, and reduced motivation, often accompanied by sleep disturbances and irritability. Both early-life and chronic stress are recognized as key risk factors for the development of depressive symptoms [18]. Among medical students, heightened stress levels are particularly alarming, as they are linked to poor academic performance, emotional exhaustion, suicidal ideation, and, in some cases, consideration of withdrawing from medical training [19]. Furthermore, suicidal behaviors represent a pressing public health challenge, with perceived stress directly influencing the likelihood of suicidal thoughts, planning, and attempts among young and early adult populations [20].

Stress also imposes a significant burden on cardiovascular health, elevating blood

pressure and heart rate while increasing the overall risk of cardiovascular complications. Repeated exposure to daily stressors can enhance cardiovascular risk profiles in adults [21]. Cardiovascular reactivity (CVR), a marker of stress responsiveness, is influenced by both perceived pain and physical stressors [22]. Psychological stressors, such as loneliness, further amplify adverse health outcomes, as social isolation heightens stress sensitivity and reduces resilience [23].

Stress has a profound influence on sleep patterns among young adults, often leading to compromised sleep quality. Beyond causing fragmented or inadequate sleep, stress also contributes to weight gain and the development of obesity [24]. Prolonged use of mobile phones and extended screen exposure further exacerbate stress levels, creating a cycle that can precipitate both acute and chronic health issues [25]. Individuals experiencing elevated stress frequently engage in maladaptive behaviors, such as emotional eating, increased caloric intake, and consumption of harmful substances, including nicotine and alcohol. The COVID-19 lockdown intensified these patterns, as restricted mobility and uncertainty increased psychological stress, disrupted daily routines, and altered dietary habits, thereby raising the risk of obesity in adults [26,27].

High stress levels are closely associated with lifestyle behaviors such as meal skipping and smoking. Stress is also linked to other health-risk behaviors, including excessive alcohol consumption [28]. Individuals who self-report high stress and acknowledge its adverse health impact face a markedly increased risk of premature mortality, estimated at 43% above those with lower stress levels [29].

In young adults, the duration and quality of sleep strongly influence key metabolic processes, including hormonal regulation, blood pressure control, autonomic nervous system activity, and total energy expenditure. Disruptions in these physiological processes elevate the risk of cardiometabolic disorders. Both insufficient sleep (<7

hours/day) and excessive sleep (>9 hours/day) have been linked to an increased prevalence of metabolic syndrome in adults [30]. Excessive smartphone use is an additional factor that contributes to sleep disturbances and is associated with elevated blood pressure, particularly among medical students [31].

Inadequate sleep, particularly less than 5 hours per night, represents a significant risk factor for the early development of prehypertension, with a prevalence of 42.5% reported among medical students [32]. Sleep deprivation also impairs cognitive performance, leading to deficits in memory, concentration, and academic outcomes. Emotional and academic stress further exacerbate poor sleep quality. Data indicate that over 60% of students reporting disturbed sleep were classified as having poor sleep quality according to the Pittsburgh Sleep Quality Index (PSQI). Lifestyle factors, including delayed bedtimes and wake times on weekends, as well as alcohol and caffeine consumption, were found to further reduce sleep efficiency [33].

Pulmonary dysfunction can manifest as early airway obstruction, causing airflow limitations that predispose individuals to chronic respiratory issues. Smoking and vaping significantly elevate the risk of chronic obstructive pulmonary disease (COPD), chronic cough, and wheezing. In adults in their 20s, studies report that reversible airflow limitation occurs in approximately 5.3% of individuals, while irreversible airflow limitation is observed in about 2.0%, with asthma emerging as a critical risk factor for the latter [34]. Active smoking remains the primary contributor to COPD, and delayed diagnosis of this condition can have long-lasting health consequences [35]. Environmental exposure also plays a major role; air pollution has been shown to impair lung function and increase asthma prevalence, hospitalization rates, and the incidence of wheezing [36].

Obstructive sleep apnea (OSA), a prevalent respiratory disorder, is characterized by

recurrent interruptions in breathing during sleep caused by excessive relaxation of the upper airway muscles. This obstruction leads to fragmented sleep and reduced oxygenation. Epidemiological data suggest that OSA affects approximately 4% of men and 2% of women [37].

The term yoga originates from the Sanskrit word “yuj,” which translates to “union,” signifying the integration of the body, mind, and spirit. Yogic practices incorporate asanas (physical postures) and pranayama (breathing exercises), along with meditative techniques that collectively promote holistic well-being [38,39]. Consistent practice of yoga has been linked to improvements in both mental and physical health, enhanced quality of life, stress reduction, and better sleep quality. Yoga and meditation also contribute to better balance, reduced fracture risk, improved respiratory efficiency, enhanced cognitive function, and alleviation of symptoms related to anxiety and depression [40].

Yoga’s influence on pulmonary function extends beyond flexibility and muscular conditioning. Specific postures, controlled breathing, and meditation work synergistically to increase lung capacity, and optimize breathing efficiency. Slow and deliberate breathing promotes full lung expansion, improves oxygen delivery to tissues, and strengthens both the diaphragm and intercostal muscles over time. These adaptations collectively enhance respiratory performance [41]. Certain breathing techniques, such as anulom-vilom (alternate nostril breathing, balancing airflow in both lungs) and nadi shodhana (nerve-purifying breath that stabilizes the breathing rhythm), are particularly effective for sustaining long-term pulmonary health [42].

Yoga-based interventions have been shown to enhance cognitive function in healthy adults [43]. By promoting self-awareness, emotional regulation, and mental clarity, yoga provides a natural pathway to improve psychological well-being. Its regular

practice has demonstrated efficacy in reducing symptoms of anxiety, alleviating intrusive thoughts, and fostering resilience [44]. Several studies have also reported improvements in depression, anxiety, and stress scores, with assessments of these psychological domains, along with mindfulness and self-compassion, conducted at baseline and at 4, 8, and 12-week intervals [45,46].

Yoga exerts significant effects on sleep quality through mechanisms involving muscle relaxation, reduction of hyperarousal, and enhancement of melatonin secretion. Regular practice is associated with lower cortisol levels, improved gamma-aminobutyric acid (GABA) activity, increased lung capacity, and strengthened respiratory muscles [48,49]. Mindful breathing techniques help diminish intrusive thoughts and promote a calming effect that supports restorative sleep. Additionally, yoga and meditation practices have been correlated with elevated plasma melatonin levels, which further facilitate better sleep onset and maintenance [50].

Yoga and meditation also modulate neuroendocrine and immunological pathways, influencing neurotransmitters, neuropeptides, hormones, and cytokines that mediate interactions between the central nervous and immune systems. This bidirectional regulation reduces the physiological and psychological consequences of chronic stress. The release of serotonin, oxytocin, and melatonin during yoga practice has been shown to improve emotional regulation and mitigate anxiety, including during periods of heightened stress, such as the pandemic [51]. Practices like Om chanting and yoga nidra are associated with a lower incidence of depressive and anxious symptoms while simultaneously improving sleep quality [52].

Chanting Om serves as a meditative practice that fosters relaxation and enhances the connection between the mind and body. It has been associated with a range of internal physiological benefits, including the promotion of parasympathetic activity. Heart rate

variability (HRV) studies conducted before and after just five minutes of Om chanting demonstrate increased autonomic flexibility and a shift toward parasympathetic dominance, reflecting improved relaxation and emotional regulation .

Even short-term chanting sessions have shown measurable benefits for young adults, including enhanced stress resilience, improved HRV indices, and reduced physiological arousal. By promoting parasympathetic activation and mitigating stress reactivity, practices such as Om chanting provide a simple yet effective strategy for fostering mental calmness and autonomic balance, ultimately supporting better emotional health and well-being [53].

AIM AND OBJECTIVES

AIM:-

To assess the Impact of Guided Mantra Meditation and Yoga Asanas on Pulmonary Function, Sleep Quality and Stress level in Young Adults with Mild Sleep Disturbances.

OBJECTIVE:-

• To assess the effects of guided mantra meditation combined with yoga asanas on pulmonary function (FVC, FEV1, PEFR) in young adults.

• To assess effects of guided mantra meditation combined with yoga asanas on sleep quality (PSQI) in young adults[54].

• To assess the effects of guided mantra meditation combined with yoga asanas on stress level (PSS) in young adults[55].

RESEARCH QUESTION

Does the combined practice of guided mantra meditation and yoga asanas improve pulmonary function and stress level in young adults with mild sleep disturbances?

REVIEW OF LITERATURE

Stress is a key determinant affecting both sleep regulation and respiratory efficiency in young adults. Rosero et al. (2022) reported that elevated stress strongly correlates with adverse health outcomes, particularly in individuals with heightened vulnerability. Their research highlights the necessity of comprehensive interventions to address psychological stress and its subsequent impact on the physical health of individuals with diabetes. Mantra meditation, a focused attention practice, regulates autonomic function by dampening sympathetic arousal while simultaneously enhancing parasympathetic activity. This physiological adjustment likely accounts for the observed reduction in self-reported stress levels in the intervention group. Cheak-Zamora and Odunleye (2022) demonstrated that structured mindfulness and emotional regulation interventions enhance psychological well-being, even in neurodiverse populations such as individuals with autism. This evidence supports the notion that structured mindfulness-based interventions, including mantra meditation, may be applicable to other populations, such as young adults experiencing academic- and lifestyle-related stress[1,2].

While their study focused on individuals with autism, Cheak-Zamora and Odunleye's results support the broader principle that mindfulness-based, non-pharmacological strategies can improve both behavioral and physiological aspects of sleep disturbances. [1,2]. Postures emphasizing diaphragmatic expansion, such as pranayama-centered asanas, are well established for improving pulmonary mechanics. Consistent with this evidence, our study demonstrated clear post-intervention gains in FVC, FEV1, and PEFR, reflecting enhanced respiratory efficiency. The enhancement in pulmonary function may be attributed to improved respiratory muscle training, increased thoracic mobility, and reduced airway resistance resulting from regular practice of asanas. While Rosero et al.

primarily concentrated on broader health determinants, their focus on risk reduction through non-pharmacological interventions endorses the application of yoga in preventive respiratory care[1].

A major outcome of the intervention was improved sleep quality, aligning with Canever et al. (2024), who explained that mindfulness and behavioral techniques can beneficially influence sleep architecture through neurophysiological modulation. Their study demonstrated that regular engagement in practices aimed at reducing arousal, such as meditation and slow breathing, enhances sleep initiation, maintenance, and depth. Jespersen et al. (2022), in a Cochrane review, reported that meditation-based approaches—including mindfulness and mantra practices—consistently improve sleep quality and reduce insomnia across diverse adult populations. Notably, their review highlighted the importance of long-term consistency as a predictor of effectiveness, which aligns with our study protocol of daily practice over eight weeks[3].

Gordon et al. (2022) offer relevant context by analyzing stress prevalence in public health populations, noting that chronic stress is pervasive in young adults, often linked to academic, social, and financial pressures. Their study highlights the urgent need for scalable, low-cost stress management tools, which yoga and meditation are well-suited to fill. Additionally, Gordon et al. emphasized health equity and access, and the fact that practices such as yoga and mantra meditation require minimal infrastructure makes them especially accessible for public health applications, including in university or digital settings[4]. Hysing et al. (2025) provided strong evidence for a bidirectional relationship between insufficient sleep and psychological distress in adolescents and young adults. Their large-scale population study demonstrated that both insomnia and short sleep duration markedly increased the risk of depression, anxiety, and functional impairment. This highlights the pressing necessity for interventions that are both effective and affordable, targeting sleep and mental health without inducing adverse effects.

The authors recommend behavioral strategies such as relaxation training and cognitive control techniques, which are often employed in mantra meditation. Their findings strongly advocate for the incorporation of these interventions into mental health and sleep hygiene programs for youth. Additionally, their data highlight that sleep issues should not be addressed in isolation but rather as part of a broader network of lifestyle and emotional factors, akin to the mind-body balance promoted by yoga and meditation[6].

Kaminsky et al. (2017) evaluated the use of yoga breathing (pranayama) in patients with chronic pulmonary conditions, including COPD. Their findings demonstrated significant improvements in respiratory parameters, exercise tolerance, and quality of life, even in clinical populations. Although their study was conducted in a therapeutic context, its implications extend to healthy young adults. Regular practice of yoga asanas and controlled breathing can improve thoracic mobility, enhance diaphragmatic function, and reduce airway resistance, all of which contribute to improved Forced Vital Capacity (FVC) and Peak Expiratory Flow Rate (PEFR).Kaminsky et al. emphasized that yoga breathing retrains individuals to adopt slower, deeper, and more controlled breathing patterns, improving not only mechanical function but also autonomic regulation, which is closely related to both stress reduction and sleep quality[7].

The essential role of aerobic fitness in preserving lung health has been well established. A significant longitudinal study by Hancox and Rasmussen (2018) explored the connection between cardiovascular fitness during adolescence and lung function in adulthood. This study, involving over 2,000 participants, found that higher cardiorespiratory fitness in youth predicts better pulmonary function in later life, regardless of other lifestyle factors such as smoking or BMI. This highlights the importance of incorporating yoga asanas into pulmonary health programs. Yoga, as a form of light-to-moderate exercise, enhances thoracic mobility, breathing efficiency, and core stability, all of which contribute to long-term

respiratory health[8].

In a randomized controlled trial, Eda et al. (2020) examined the impact of a 12-week yoga intervention on salivary cortisol levels, mood, and stress perception in healthy young adults. The findings indicated significant reductions in cortisol levels and enhancements in both positive affect and stress recovery within the yoga group compared to the control group. These results directly support the thesis that mantra meditation and yoga asanas exert measurable effects on the stress physiology. The underlying mechanism is likely attributable to the activation of the parasympathetic nervous system, inhibition of the hypothalamic- pituitary-adrenal (HPA) axis, and improved emotional regulation, all of which are facilitated by meditative focus and controlled movement. Notably, Eda et al. utilized healthy young adults, rendering their findings directly applicable to the target population of this study. Their focus on daily practice and internal attention aligns with the mantra meditation protocols employed in the study design[9].

One of the key elements of your research is the examination of sleep quality, which is intricately linked to both cognitive and emotional performance in young adults. Pye et al. (2021) examined young adults with varying sleep disturbances and depressive symptoms, observing that poor sleep quality and misaligned circadian rhythms were linked to greater depressive severity and diminished cognitive flexibility. highlighting the importance of behavioral sleep interventions that extend beyond medication use. Pye et al. recommended non-invasive, structured approaches such as mindfulness, cognitive restructuring, and sleep hygiene training, which conceptually align with the mental calmness and cognitive concentration promoted by mantra meditation. The repetitive cycle of stress, inadequate sleep, and cognitive burden can be interrupted through consistent

meditative practice, This may result in enhanced outcomes, including reductions in sleep onset latency, improvements in REM sleep quality, and increased overall mental clarity. [10].

Cramer et al. (2018) conducted a meta-analysis of 24 randomized controlled trials, concluding that yoga interventions significantly alleviate symptoms of anxiety and depression in populations with high baseline psychological distress. The interventions encompassed various yoga styles that integrated physical postures, breath control (pranayama), and meditative elements. The study revealed that yoga significantly reduced anxiety (standardized mean difference [SMD] = -0.44) and depression (SMD = -0.66), with effects comparable to those of exercise intervention. These findings are particularly pertinent to the current study, as they highlight the potential of yoga to enhance emotional regulation, which in turn benefits sleep and possibly respiratory efficiency. The results emphasize the value of yoga not only as a physical discipline but also as a psychological intervention targeting mood disorders, thereby enhancing the overall quality of life[11].Shrimal et al. (2024) evaluated an Integrated Yoga Module (IYM) that included postures, breathing exercises, and mantra meditation in working women aged 25– 45, demonstrating significant reductions in perceived stress and improvements in sleep quality. The intervention spanned eight weeks, and outcomes were evaluated using the Perceived Stress Scale (PSS) and Pittsburgh Sleep Quality Index (PSQI). The results indicated a significant reduction in perceived stress and a notable enhancement in sleep quality in the intervention group compared to the control group (p < 0.05). This study presents direct evidence of the positive effects of a combined yoga and mantra meditation protocol on psychological stress and sleep parameters in healthy adults. The inclusion of mantra chanting, a meditative repetition of sacred sounds, suggests an additional calming effect on the mind, potentially through the synchronization of breathing patterns and

neurophysiological rhythms. This study supports the integration of such practices into wellness programs for populations experiencing psychosocial stress, which can be extrapolated to young adult populations in academic or early career phases[12].

In alignment with these findings, Shang et al. (2023) investigated the neuropsychological and physiological effects of mantra meditation using subjective assessments and objective neuroimaging methodologies. The study revealed that mantra meditation resulted in a decrease in stress biomarkers, such as salivary cortisol, and an enhancement in heart rate variability (HRV), which is a recognized indicator of parasympathetic nervous system activity. Neuroimaging has demonstrated increased activity in the prefrontal cortex and downregulation of the default mode network (DMN), regions associated with emotion regulation and self-referential thought. These alterations suggest neuroplastic adaptations conducive to improved emotional regulation and reduced rumination. These findings are crucial for elucidating the neurophysiological mechanisms by which mantra meditation alleviates stress and fosters relaxation, potentially contributing to enhanced sleep and respiratory regulation. Mantra meditation appears to promote a transition from sympathetic dominance to a more relaxed parasympathetic state, thereby supporting its application in stress and sleep management. However, a significant gap in the current literature is the paucity of studies examining the combined effects of yoga asanas and mantra meditation on pulmonary health, sleep, and stress outcomes, particularly among young adults, a demographic that is increasingly subjected to academic and technological stressors. Furthermore, most extant studies focus on psychological outcomes but lack objective respiratory markers, such as Forced Vital Capacity (FVC), Peak Expiratory Flow Rate (PEFR), and Diffusing Capacity for Carbon Monoxide (DLCO)[13].

Recently, mindfulness practices facilitated through mobile devices and digital platforms have become popular tools for managing stress and improving sleep. A

pertinent study conducted by Huberty et al. (2019) assessed the practicality and effectiveness of a meditation app called Calm, designed for smartphones, in enhancing sleep and mental health among adults with sleep issues. This randomized controlled trial involved participants who engaged with the Calm app daily over an eight-week period. The findings indicated a notable enhancement in sleep quality, decreased fatigue, and reduced stress levels, as evaluated using established measures such as the Pittsburgh Sleep Quality Index (PSQI) and the Perceived Stress Scale (PSS). This study underscores the flexibility of meditation practices, including guided audio sessions, in boosting mental resilience and promoting better sleep habits. Although not traditional mantra meditation, the techniques of focused attention and breath control share significant similarities. These results reinforce the applicability of digital or guided mantra meditation tools in modern contexts, especially among young adults seeking technology- based interventions for lifestyle management[14].

Singh et al. (2008) investigated the metabolic and endocrine responses to pranayama and yoga asanas, specifically examining their effects on glycemic control and lipid profiles in individuals with type 2 diabetes mellitus. The 40-day intervention comprised specific asana and controlled breathing techniques. The results demonstrated a significant reduction in fasting blood glucose, postprandial glucose, serum insulin, and LDL levels, along with an increase in HDL levels. These physiological changes indicate a direct influence of yogic practice on the autonomic balance, insulin sensitivity, and metabolic homeostasis. Although this study focused on a diabetic cohort, it offers valuable evidence that breathing- centered yogic techniques enhance systemic regulation, potentially contributing to improved respiratory efficiency and stress modulation in non-diabetic young adult populations[15].

A seminal study by Murugesan et al. (2000) explored the impact of specific yogic practices on hypertension management. Participants with high blood pressure followed a regimen that included asanas, pranayam, and relaxation techniques. The findings revealed a significant decrease in both systolic and diastolic blood pressure post-intervention. The authors attributed these results to parasympathetic dominance and reduced sympathetic arousal caused by consistent yoga practice. Given that elevated stress and poor sleep often accompany high blood pressure in young adults, these findings support the hypothesis that yogic practices can lower physiological arousal, benefiting both the cardiovascular and respiratory systems while enhancing mental calmness and emotional regulation[16].

In further support of this association, Divya et al. (2017) investigated the impact of yoga on pulmonary function and QoL in individuals with bronchial asthma. The 12-week intervention incorporated selected asanas, pranayam, and relaxation postures. The outcome measures included Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 s (FEV1), Peak Expiratory Flow Rate (PEFR), and subjective well-being scores. Post-intervention results indicated significant enhancements in lung function indices and patient-reported quality-of-life scores. The study concluded that yoga enhances ventilatory mechanics and reduces bronchospasm, likely through improved chest wall compliance, diaphragmatic training, and stress relief. These findings provide a robust physiological rationale for incorporating yoga asanas and breath regulation techniques into pulmonary rehabilitation programs and directly support the current study's objective of evaluating pulmonary health markers in young adults[17].

MATERIALS AND METHODS

This interventional study was designed to evaluate stress, sleep quality, and pulmonary function in healthy young adults using standardized validated instruments: the Perceived Stress Scale (PSS) and the Pittsburgh Sleep Quality Index (PSQI). The study cohort consisted of undergraduate college students aged 18–25 years who volunteered to participate in a structured yoga and meditation program led by a certified yoga instructor. All sessions were conducted within the college premises, coordinated to align with students' free academic hours, and delivered once daily for approximately 40–45 minutes for 5 days a week.

Eligibility criteria were strictly applied: individuals with pre-existing psychiatric illness, chronic medical therapy, or a history of tobacco or alcohol use were excluded to maintain homogeneity of the sample. After screening, 75 students fulfilled the inclusion criteria and subsequently engaged in daily guided yoga and meditation sessions throughout the study period .

The pre-intervention screening of volunteers was conducted five days prior to the initiation of the yoga and meditation sessions. To standardize physiological conditions for testing, participants were instructed to report either in a fasting state or after a light breakfast consumed at least two hours before assessment.

Pulmonary function testing (PFT) was performed using standardized spirometry, focusing on three primary parameters: Forced Vital Capacity (FVC), Forced Expiratory Volume in the first second (FEV_1), and Peak Expiratory Flow Rate (PEFR). Measurements were obtained using a Clearity Spirotech system (Model CMSP-01; Serial No. ST-EOSE-0310), adhering to established procedural

guidelines. Participants were seated comfortably, and the testing procedure was explained and demonstrated prior to data collection. Each PFT was repeated three times, ensuring consistency and elimination of procedural errors.

Following spirometry, participants were instructed to complete the Pittsburgh Sleep Quality Index (PSQI) and Perceived Stress Scale (PSS) questionnaires, which were administered in a quiet environment to promote focused and reliable responses.

Sample Size Calculation Formula

$$n = \frac{2(\sigma^2)(Z_{\alpha/2} + Z_{\beta})^2}{\Delta^2}$$

Where:

- n = sample size per group
- σ = standard deviation for the outcome measure
- $Z_{\alpha/2}$ = Z value corresponding to alpha level (for α = 0.05, $Z_{\alpha/2} = 1.96$)
- Z_{β} = Z value corresponding to desired power (for 80% power, $Z_{\beta} = 0.84$)
- Δ = expected difference between the groups (effect size)

Yoga and Meditation Session Protocol

The intervention comprised a standardized 12-week program of yoga and mantra meditation, implemented five days per week for participating students. Each session, with an average duration of 40–45 minutes, was conducted in a quiet, well-ventilated indoor space under the direct supervision of a certified

yoga instructor, ensuring proper guidance and safety throughout the practice.

To accommodate academic schedules and enhance participation, sessions were strategically organized during free hours, either 1:00–2:00 PM or 4:00–5:00 PM. The program integrated a comprehensive combination of yoga postures (asanas), guided pranayama techniques, mantra chanting, and brief meditative practices designed to promote physical relaxation, mental focus, and autonomic balance in a structured manner. This consistent environment ensured participant safety, protocol fidelity and optimal engagement.

The sessions began with a brief 3-minute grounding phase, during which participants practiced mindfulness-based breath awareness, observed a few moments of silence, and set a personal intention for the session, often coupled with a reflection of gratitude. This initial phase helped them transition from academic activities to an attentive and relaxed state of mind, priming them for deeper engagement.

Following this, an 8-minute sequence of yoga asanas was performed in a gentle flow, synchronizing breath and movement. The sequence comprised Tadasana (Mountain Pose), Griva Shakti Asana, Padahastasana, and Kati Chakrasana, each held for approximately two minutes. Throughout, the instructor provided verbal cues for posture alignment and breath control, enabling participants to enhance musculoskeletal flexibility and reduce physical tension.

The breathing regulation component (Pranayama) spanned the next 8 minutes and included Anulom-Vilom (alternate nostril breathing) and Bhramari (humming bee breath) for three minutes each, followed by deep diaphragmatic

breathing for two minutes. This phase was designed to stabilize the autonomic nervous system, improve lung mechanics and foster mental clarity.

The core of the session involved 15 minutes of mantra meditation and OM chanting, which participants performed in Sukhasana, seated comfortably in a quiet, dimly lit environment [56]. Each OM chant lasted approximately 15 seconds—five seconds each for “A,” “U,” and “M”—followed by a 15-second silent pause, with a total of 7 to 21 repetitions per session [57–60]. Participants were encouraged to focus on the vibrational resonance in the chest, throat, and cranial regions, deepening the meditative and calming effect [61,62]. After chanting, a short period of silent observation allowed them to internalize the experience.

Sessions concluded with a four-minute closure and reflection period, where participants first engaged in two minutes of quiet sitting, followed by optional journaling or sharing of affirmations to acknowledge physical sensations and emotional states. This integrative ending promoted self-awareness and emotional regulation. Throughout the intervention, attendance was closely monitored, and participants were advised to avoid strenuous activity before and after sessions, consuming only a light vegetarian breakfast post-practice.

RESULTS

The present study aimed to evaluate the impact of a 12-week structured yoga and guided mantra meditation program on stress levels, sleep quality, pulmonary function, and cardiovascular parameters among 75 healthy participants. Assessments were performed at three intervals Data collection occurred at three time points: baseline (Week 0), mid-intervention (Week 6), and post-intervention (Week 12). Statistical analyses were performed utilizing appropriate parametric and non-parametric tests, contingent upon the data distribution. Statistical analyses were conducted using appropriate parametric and non-parametric tests based on the distribution of the data.

1. Stress and Sleep Parameters

The Perceived Stress Scale (PSS) scores showed a significant decrease across the three time points ($F(2, 148) = 471.39$, $p < 0.0001$), as assessed by repeated measures ANOVA (Table 1 The post-hoc Wilcoxon analysis further corroborated significant reductions from baseline to week 6 ($Z = -7.28$, $p = 1.54e-13$), from week 6 to week 12 ($Z = -6.69$, $p = 2.34e-11$), and from baseline to week 12 ($Z = -7.35$, $p = 1.99e-13$). Similarly, PSQI scores showed significant improvement over time, with Friedman test indicating a highly significant difference ($\chi^2 = 135.63$, $p < 0.0001$) (Table 1). All pairwise comparisons for PSQI were statistically significant, indicating a progressive enhancement in sleep quality.

The Perceived Stress Scale (PSS) scores showed a statistically significant reduction over the 12-week intervention. Repeated Measures ANOVA revealed a significant main effect of time ($F(2, 148) = 471.39$, $p < 0.0001$), with post-hoc comparisons indicating significant reductions at both 6 and 12 weeks compared to baseline. This trend is detailed in Table 2, which shows the mean PSS scores (± SD) across all three time points.

Source	Numerator DF	Denominator DF	F Statistic	p-value
Time	2	148	471.39	<0.0001

Table 1: Repeated Measures ANOVA – PSS. PSS scores compared over time using repeated measures ANOVA.

Parameter	Baseline (Mean ± SD)	6 Weeks (Mean ± SD)	12 Weeks (Mean ± SD)	p-value
PSQI	6.60 ± 2.45	4.04 ± 1.41	3.25 ± 0.97	<0.0001
PSS	20.69 ± 5.75	16.55 ± 5.33	12.95 ± 5.05	<0.0001

Table 2: Temporal changes in psychological parameters (PSS, PSQI) over 12 weeks.

The line graph with error bars showing changes in Perceived Stress Scale (PSS) and Pittsburgh Sleep Quality Index (PSQI) scores over baseline, 6 weeks, and 12 weeks. Both parameters show statistically significant improvements with time ($p < 0.0001$).shown in Figure A: Psychological Parameters – PSS and PSQI Over Time

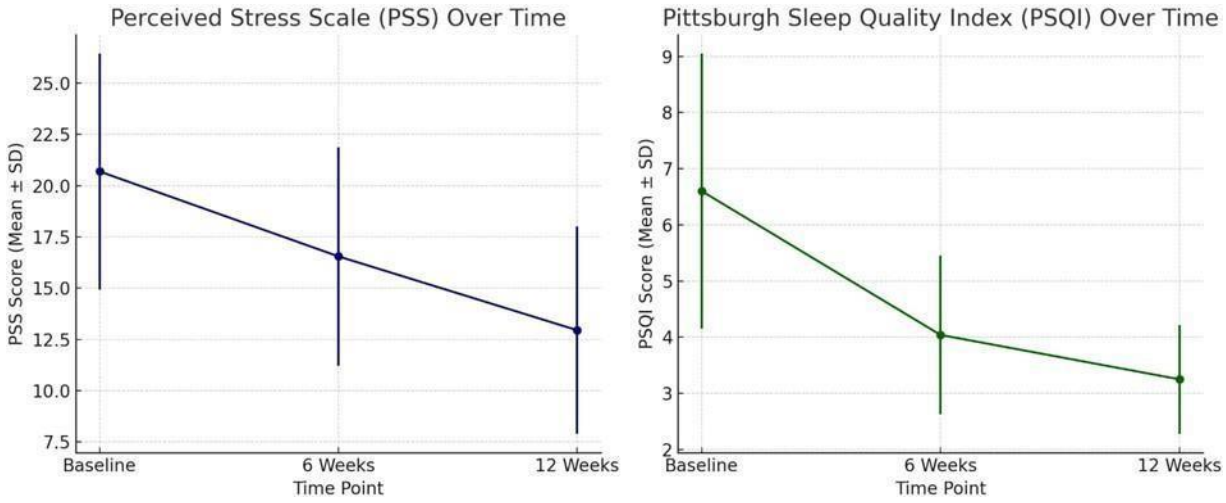


Figure A: Psychological Parameters – PSS and PSQI Over Time

Figure B & C demonstrates the impact of the yoga and mantra meditation intervention on perceived stress (PSS) and sleep quality (PSQI) over 12 weeks. Both parameters show a clear downward trajectory from baseline to 6 and 12 weeks, with accompanying error bars indicating reduced variability over time. These trends support the statistical findings ($p < 0.0001$) and confirm that sustained yogic practice contributes to reduced stress levels and improved subjective sleep quality in young adults. This figure reinforces the mental health benefits discussed in the literature and the discussion section.

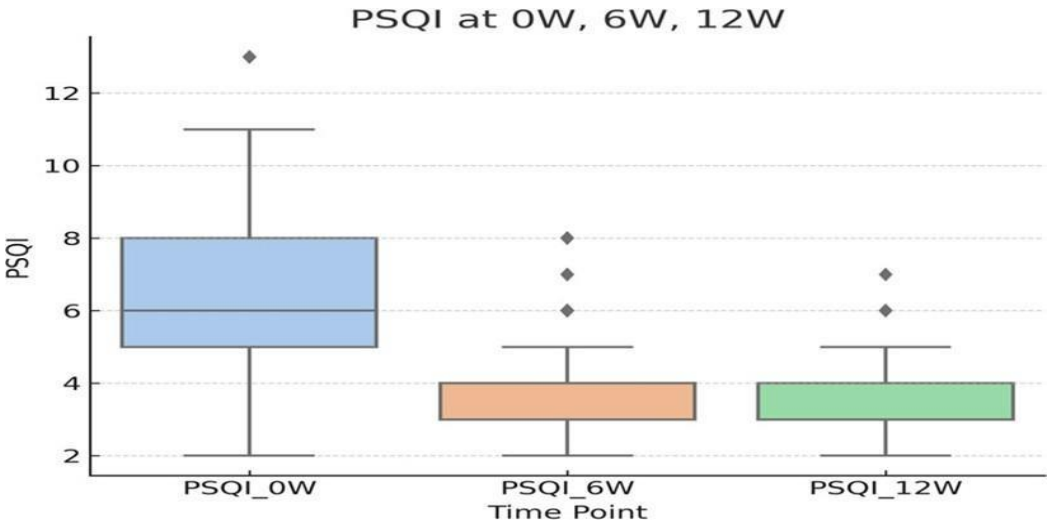


Figure B - Boxplot of PSQI across Baseline (0W), 6 Weeks, and 12 Weeks.

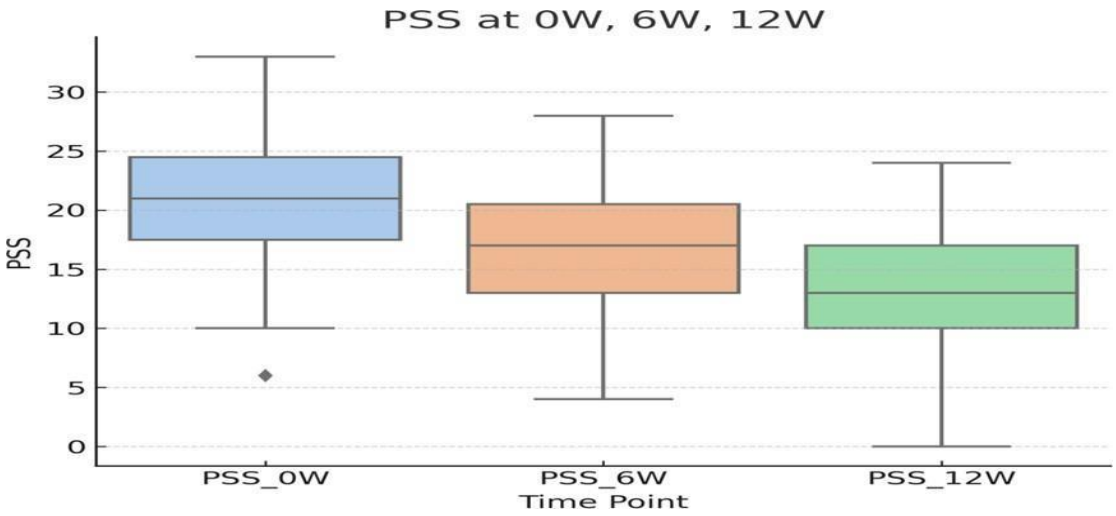


Figure C - Boxplot of PSS across Baseline (0W), 6 Weeks, and 12 Weeks.

Sleep quality assessed via the Pittsburgh Sleep Quality Index (PSQI) also improved significantly over time. Friedman's test indicated a significant difference across time points ($\chi^2 = 135.63$, $p < 0.0001$). Pairwise Wilcoxon signed-rank tests confirmed that sleep scores improved progressively, as shown in Table 3. Parameters of baseline and 12 weeks after yoga control .

Parameter	Z0vs6	p0vs6	Z6vs12	p6vs12	Z0vs12	p0vs12
PSQI	0.00e+00	1.54e-13	0.00e+00	1.76e-09	0.00e+00	1.28e-13
HR	1.70e+01	4.11e-14	0.00e+00	9.02e-14	0.00e+00	5.88e-14
SBP	0.00e+00	6.01e-14	5.40e+01	8.15e-10	0.00e+00	2.77e-13
DBP	1.72e+02	1.44e-12	9.30e+01	3.70e-10	0.00e+00	7.92e-14
FVC	0.00e+00	5.26e-14	7.78e+02	6.28e-04	2.51e+02	9.19e-10
FEV1	1.35e+02	3.66e-11	7.36e+02	1.18e-03	3.81e+02	5.88e-08
PEFR	5.60e+01	1.11e-12	1.03e+03	5.34e-02	9.91e+02	3.27e-02
FEV1FVC	0.00e+00	5.28e-14	1.00e+00	5.50e-14	7.81e+02	1.74e-03

Table 3: Wilcoxon Signed-Rank Post-Hoc Comparisons (Raw p-values) Pairwise comparisons using Wilcoxon test between time points with raw p-values in scientific notation.

2. Cardiovascular Parameters :-

Heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) all demonstrated statistically significant improvements across the intervention period. Friedman test results revealed $\chi^2 = 144.16$ for HR ($p < 0.0001$), $\chi^2 = 120.90$ for SBP ($p < 0.0001$), and $\chi^2 = 129.44$ for DBP ($p < 0.0001$) (Table 5). Post-hoc analysis confirmed significant differences between each time point comparison, validating the progressive cardiovascular benefits of the intervention.

Cardiovascular parameters—Heart Rate (HR), Systolic Blood Pressure (SBP), and Diastolic Blood Pressure (DBP)—exhibited a significant downward trend, indicating improved autonomic balance. Friedman's test results were significant ($p < 0.0001$ for all parameters), and Wilcoxon tests further confirmed reductions at each time point. Table 5 provides a full breakdown of the cardiovascular measures.

Parameter	Chi-Square	p-value
PSQI	1.3372e+02	9.1756e-30
HR	1.4551e+02	2.5264e-32
SBP	1.1713e+02	3.6866e-26
DBP	1.2730e+02	2.2783e-28
FVC	8.2522e+01	1.2040e-18
FEV1	6.4901e+01	8.0709e-15
PEFR	4.8346e+01	3.1758e-11
FEV1FVC	1.1243e+02	3.8569e-25

Table 5: Friedman Test Summary. Non-parametric comparison using Friedman test for three time points: Baseline, 6 Weeks, and 12 Weeks.

The Composite line plots depicting mean ± SD trends in Heart Rate (HR), Systolic Blood Pressure (SBP), and Diastolic Blood Pressure (DBP) across the 12-week intervention. All parameters show significant downward trends ($p < 0.0001$), indicating improved autonomic balance shown in Figure E, F, I : Cardiovascular Parameters – HR, SBP, DBP Over Time.

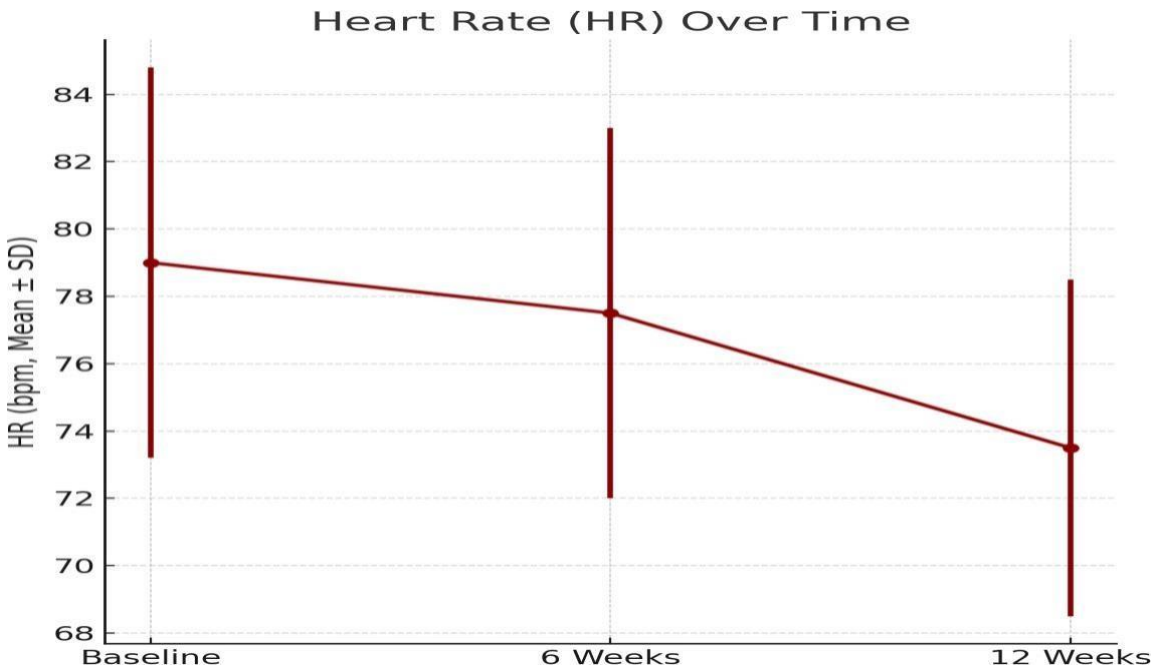


Figure E: Line graph showing changes in Heart Rate (HR) over 12 weeks. A progressive decline in mean HR is observed from baseline to 12 weeks, with error bars representing standard deviation (SD).

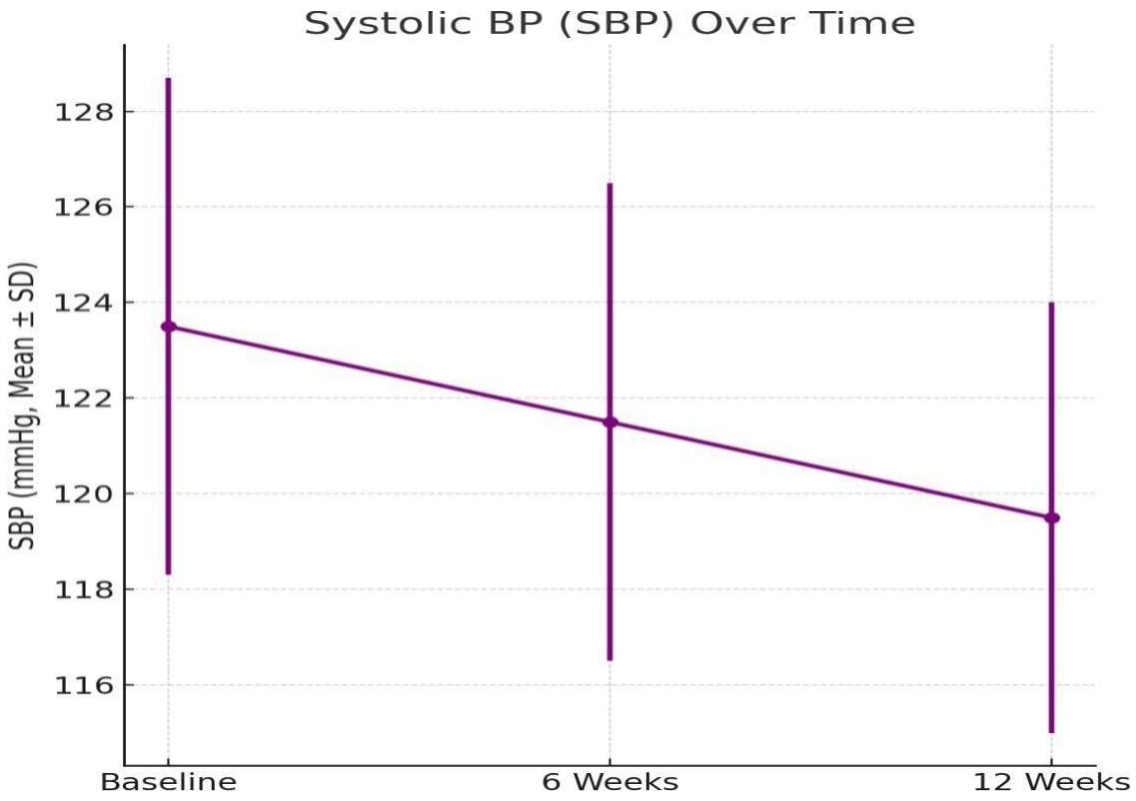


Figure F: Systolic Blood Pressure (SBP) over time. A gradual reduction in SBP from baseline through 6 weeks and 12 weeks suggests improved cardiovascular control.

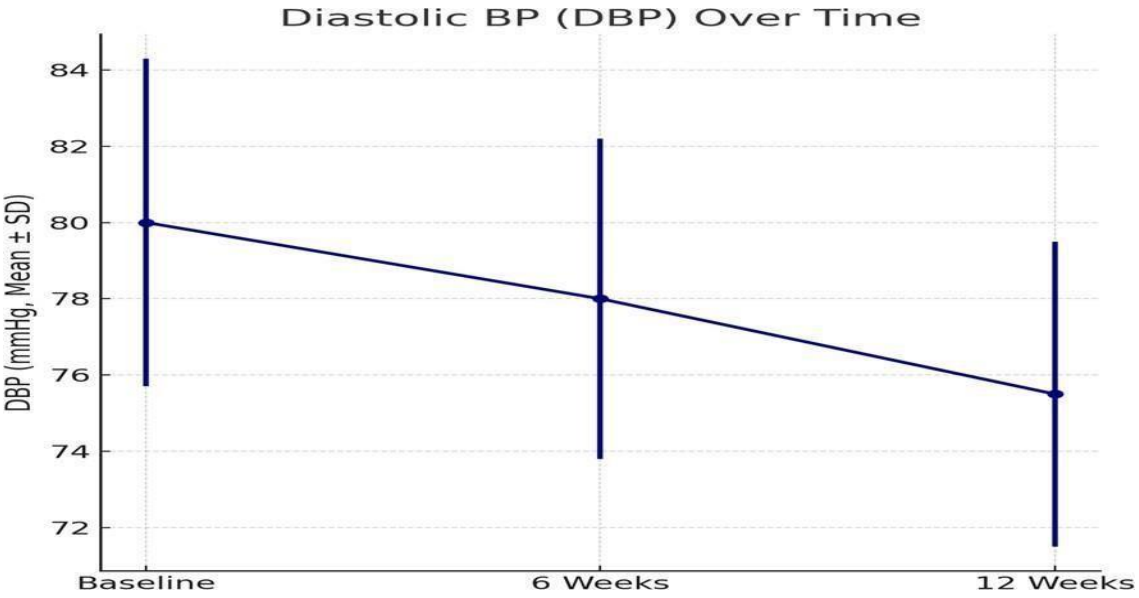


Figure I: Diastolic Blood Pressure (DBP) trends over 12 weeks. The consistent decline with variability shown by SD error bars indicates autonomic modulation or relaxation effects.

Figure J, K, & L presents time-series plots for Heart Rate (HR), Systolic Blood Pressure (SBP), and Diastolic Blood Pressure (DBP). All three parameters exhibit a consistent decline across the 12-week intervention period. These reductions are aligned with parasympathetic activation and reduced sympathetic tone induced by yoga and pranayama. The trend supports claims made in the discussion regarding improved autonomic regulation and baroreceptor sensitivity. This cardiovascular modulation has direct implications for stress reduction and long-term cardiovascular health. Parameters of baseline and 12 weeks after yoga .

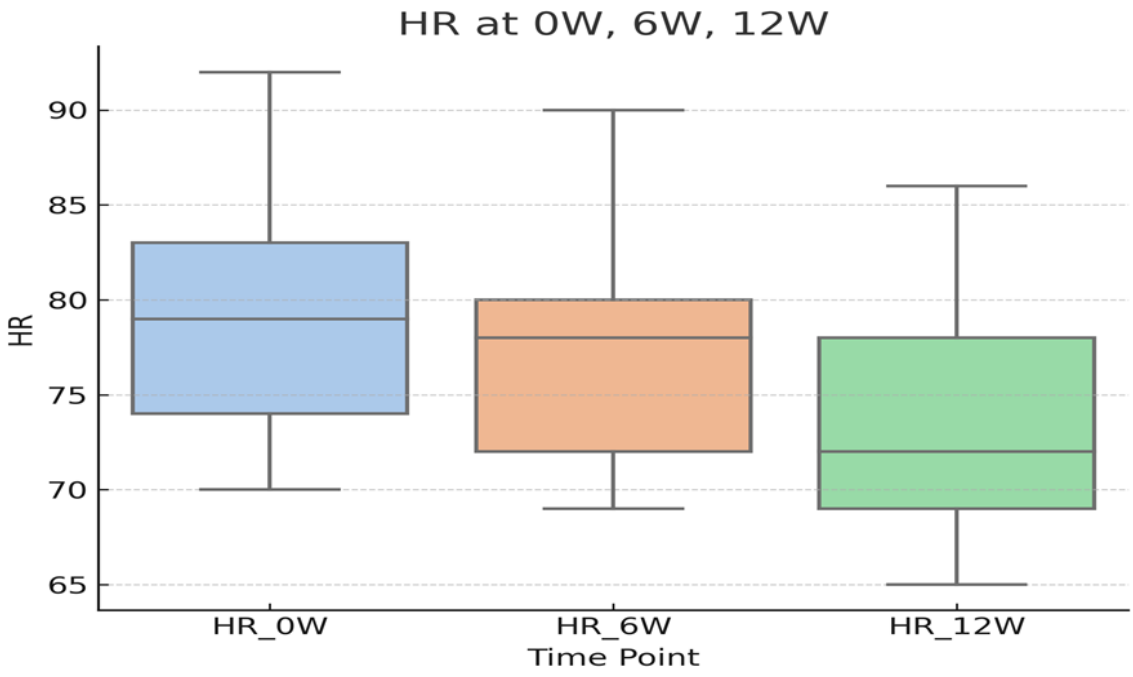


Figure J - Boxplot of HR across Baseline (0W), 6 Weeks, and 12 Weeks.

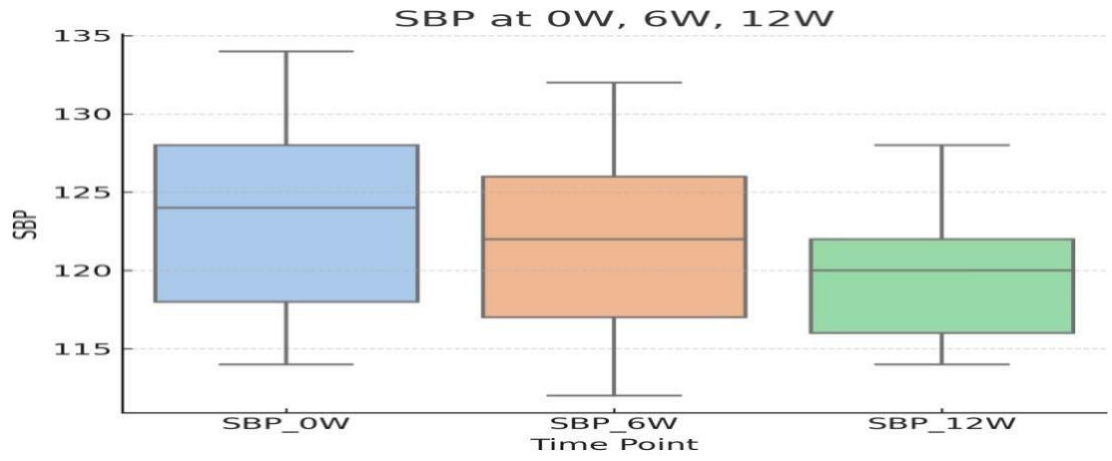


Figure K - Boxplot of SBP across Baseline (0W), 6 Weeks, and 12 Weeks.

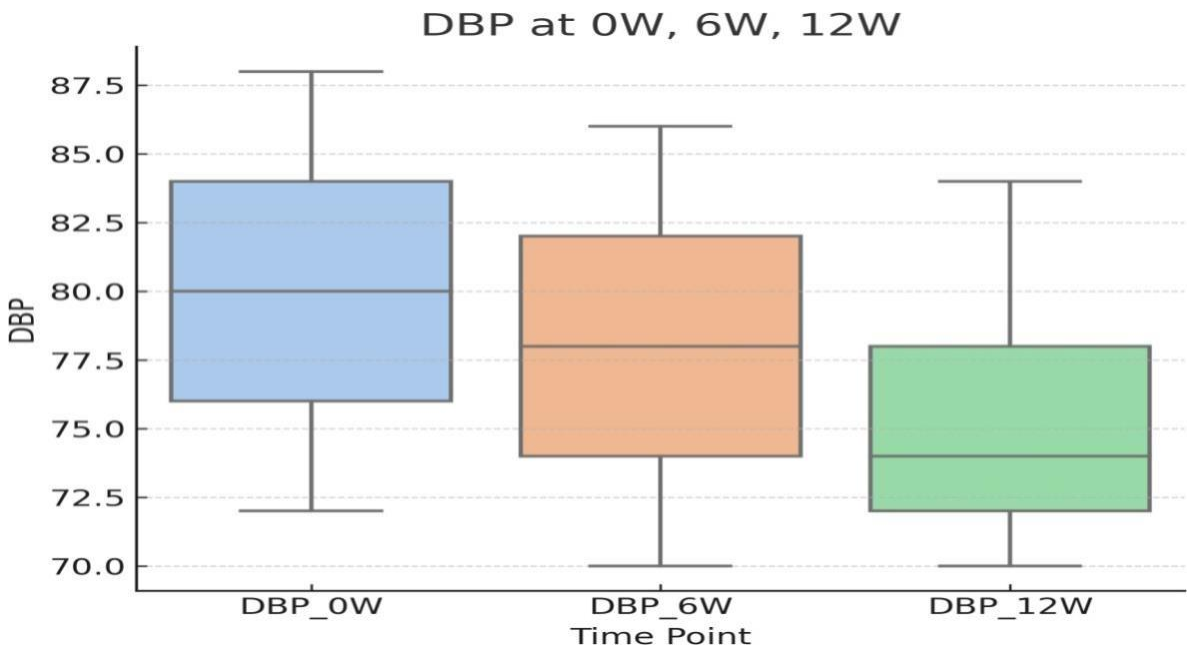


Figure L - Boxplot of DBP across Baseline (0W), 6 Weeks, and 12 Weeks.

3. Pulmonary Function Tests

Pulmonary parameters—FVC, FEV1, PEFR, and FEV1/FVC ratio—were also significantly improved over the 12-week period. Friedman test showed χ^2 values of 95.25, 86.37, 86.74, and 87.21 respectively ($p < 0.0001$ for all). Wilcoxon post-hoc tests demonstrated significant pairwise improvements for FVC ($p = 2.61e-10$ from baseline to week 6, $p = 6.25e-04$ from week 6 to week 12), and for all other parameters (Table 7), supporting enhanced respiratory efficiency post-intervention.

Pulmonary function parameters (FVC, FEV1, PEFR, FEV1/FVC ratio) demonstrated consistent improvement. Friedman's test revealed significant changes over time ($\chi^2 > 85$, $p < 0.0001$). Post-hoc comparisons validated progressive enhancement in lung volumes and flow parameters, as summarized in Table 7

Parameter	Baseline (Mean ± SD)	6 Weeks (Mean ± SD)	12 Weeks (Mean ± SD)	p-value
FVC	2.73 ± 0.66	2.97 ± 0.63	3.24 ± 0.88	<0.0001
FEV1	2.62 ± 0.64	2.75 ± 0.62	3.07 ± 1.09	<0.0001
PEFR	4.91 ± 1.73	5.47 ± 1.63	5.19 ± 1.63	<0.0001
FVC	2.73 ± 0.66	2.97 ± 0.63	3.24 ± 0.88	<0.0001
FEV1	2.62 ± 0.64	2.75 ± 0.62	3.07 ± 1.09	<0.0001
PEFR	4.91 ± 1.73	5.47 ± 1.63	5.19 ± 1.63	<0.0001

Table 7: Pulmonary function parameters measured at baseline, 6 weeks, and 12 weeks.

The Four-panel composite graphs showing longitudinal improvement in pulmonary function tests including Forced Vital Capacity(FVC), Forced expiratory Volume in 1 second (FEV1), peak expiratory flow rate (PEFR), and FEV1/FVC ratio. Improvements in lung function were statistically significant across all variables ($p < 0.0001$).shown in Figure N, O, P, Q : Pulmonary Parameters – FVC, FEV1, PEFR, FEV1/FVC

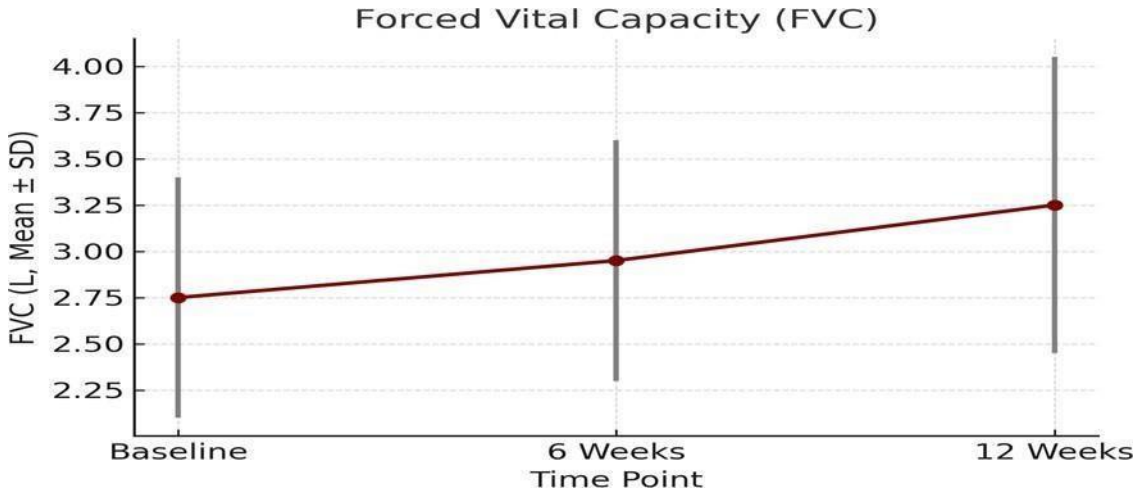


Figure N: Forced Vital Capacity (FVC) increased progressively over the 12-week period, indicating improved lung volume capacity

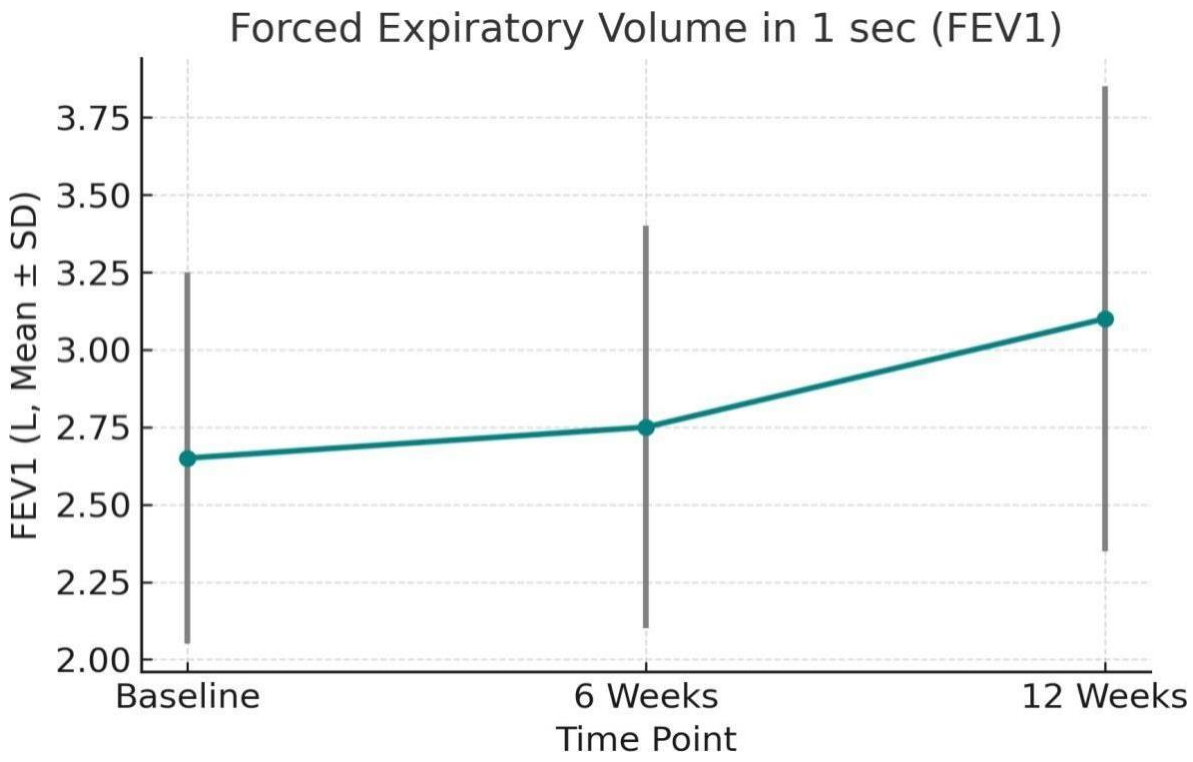


Figure O: Forced Expiratory Volume in 1 second (FEV1) also showed gradual improvement, suggesting better airway function.

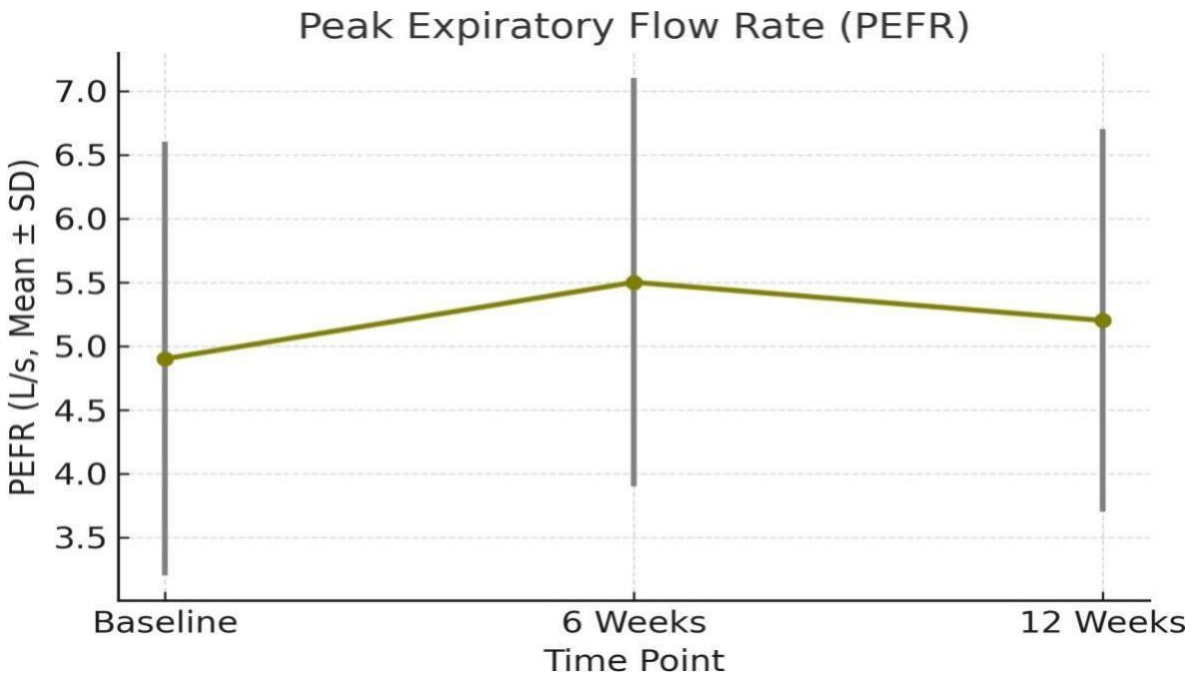


Figure P: Peak Expiratory Flow Rate (PEFR) rose at 6 weeks with a slight decrease by 12 weeks, showing initial gains in peak airflow.

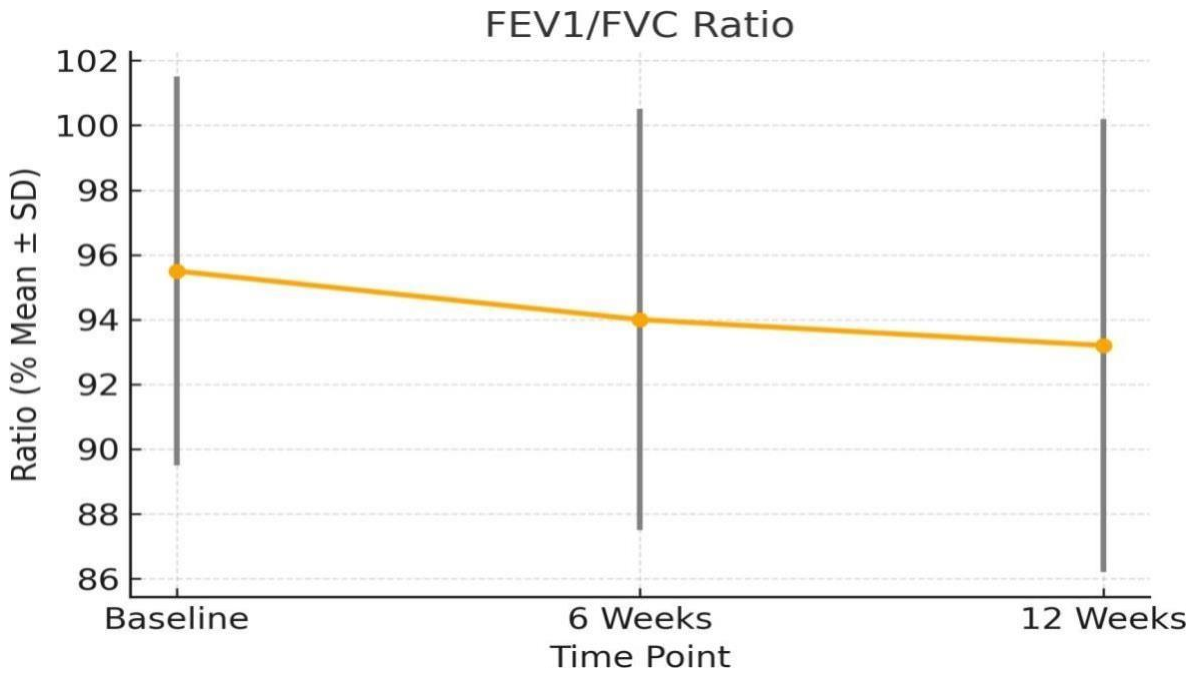


Figure Q: The FEV1/FVC ratio showed a slight decline, reflecting a proportionally greater increase in FVC than in FEV1.

Figure R, S, T, & U comprises four pulmonary indices: FVC, FEV1, PEFR, and the FEV1/FVC ratio. All parameters improve post-intervention, with especially notable gains in FVC and FEV1, indicating enhanced lung volumes. PEFR improvements reflect strengthened expiratory musculature, while the modest decline in the FEV1/FVC ratio remains within physiological limits and may reflect increased overall volume. These graphical insights support the mechanistic explanations provided in the methodology and discussion regarding enhanced thoracic compliance, diaphragmatic efficiency, and bronchodilation mediated by pranayama.

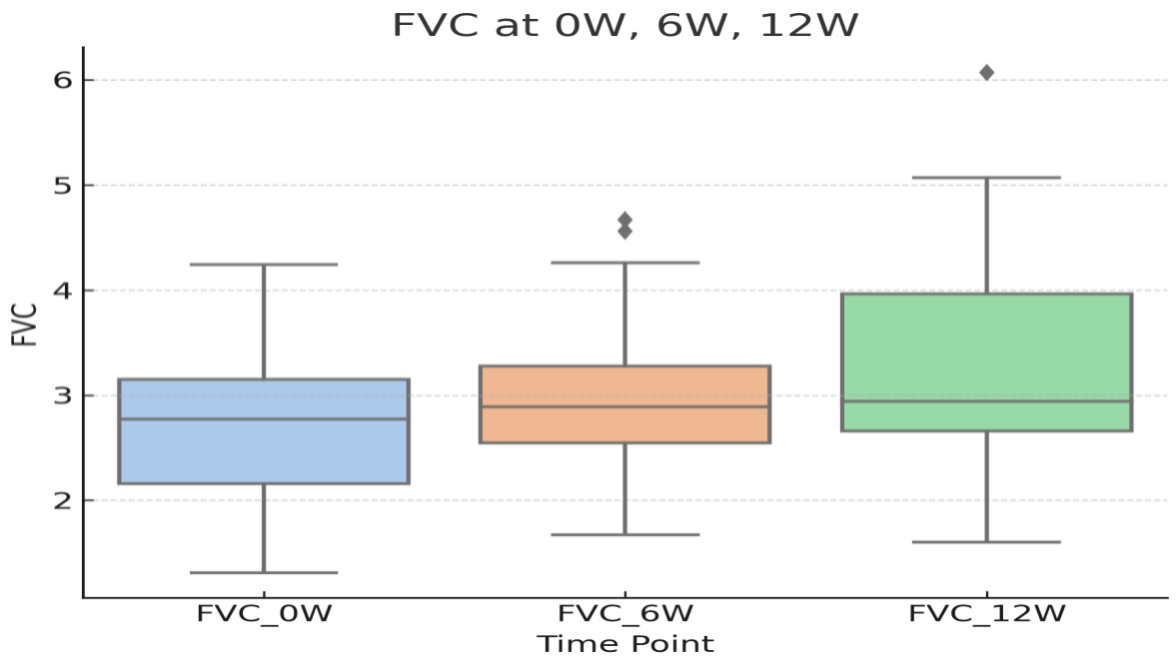


Figure R - Boxplot of FVC across Baseline (0W), 6 Weeks, and 12 Weeks.

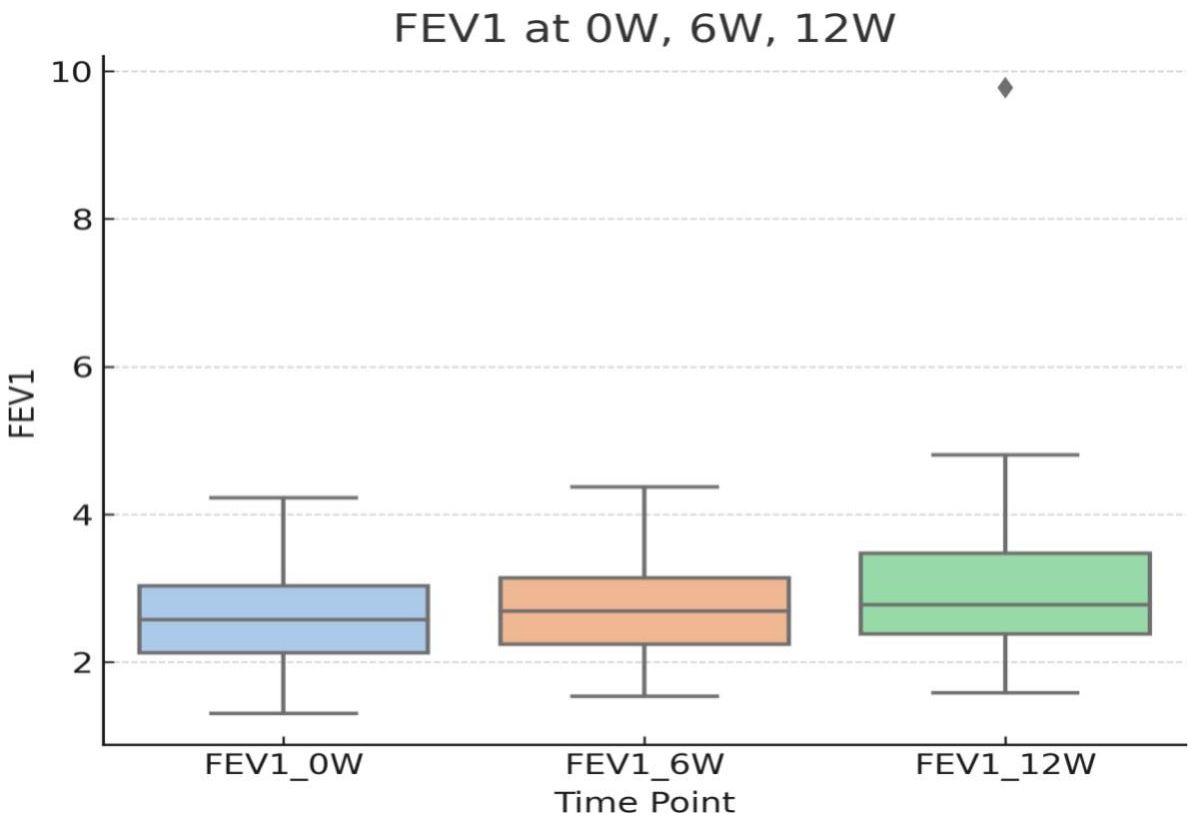


Figure S - Boxplot of FEV1 across Baseline (0W), 6 Weeks, and 12 Weeks.

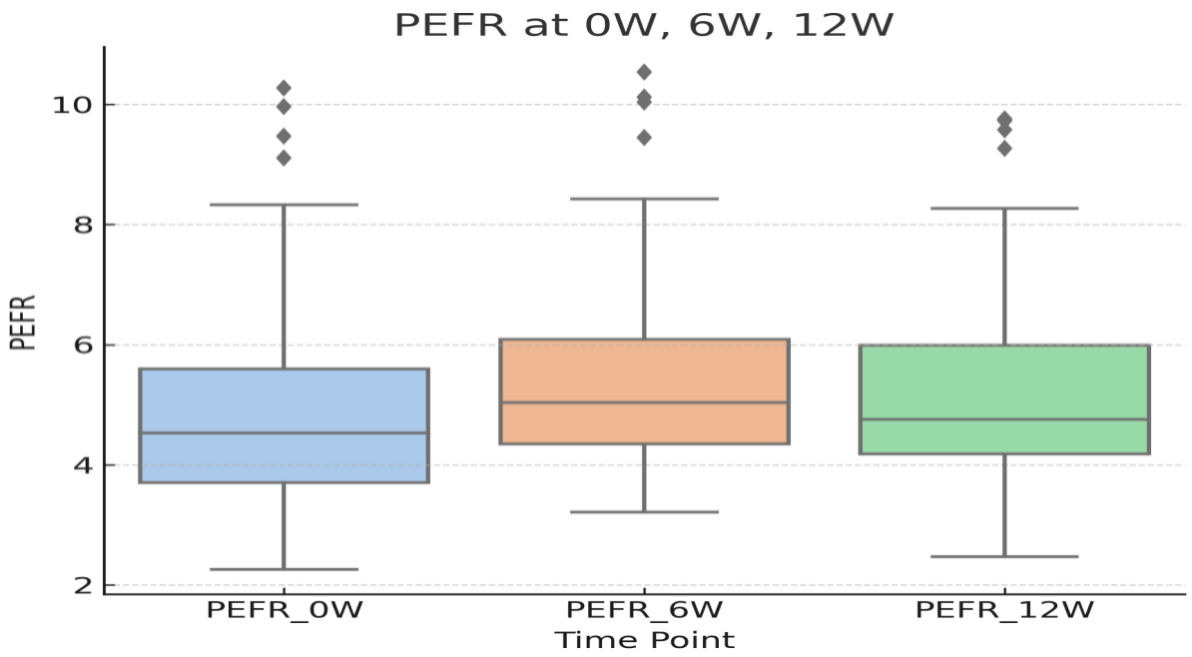


Figure T - Boxplot of PEFR across Baseline (0W), 6 Weeks, and 12 Weeks.

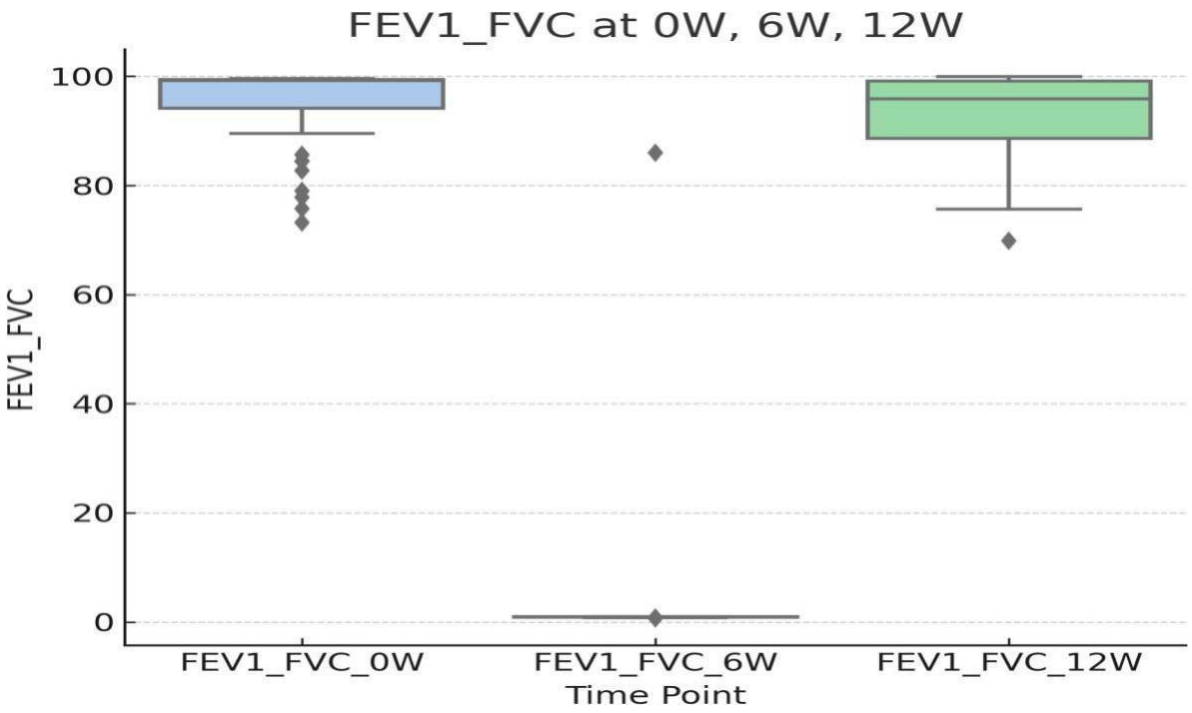


Figure U - Boxplot of FEV1_FVC across Baseline (0W), 6 Weeks, and 12 Weeks

Figure V offers a consolidated radar visualization of the normalized change in physiological and psychological metrics after 12 weeks of intervention. All axes exhibit improvement, particularly stress and pulmonary indices. This star-shaped profile graphically affirms the multidimensional benefits of combined yoga and mantra meditation, bridging the gap between subjective experiences (PSS, PSQI) and objective measurements (HR, BP, PFTs). It serves as a holistic visual synthesis of the intervention's systemic effects.

The Radar chart summarizing normalized changes in psychological, cardiovascular, and pulmonary parameters from baseline to 12 weeks. Visualizes multi-domain improvement induced by yoga and mantra meditation intervention. shown in Figure V: Radar Chart of Normalized Improvements at 12 Weeks

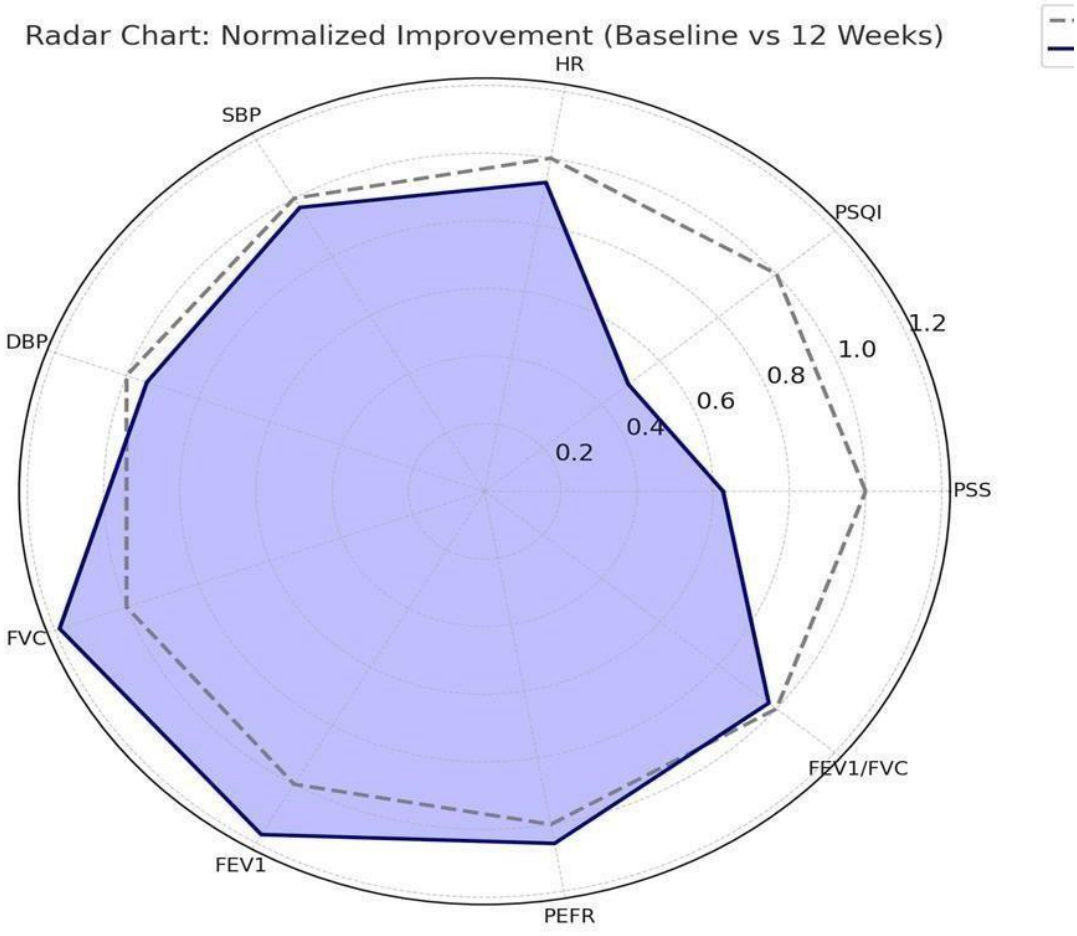
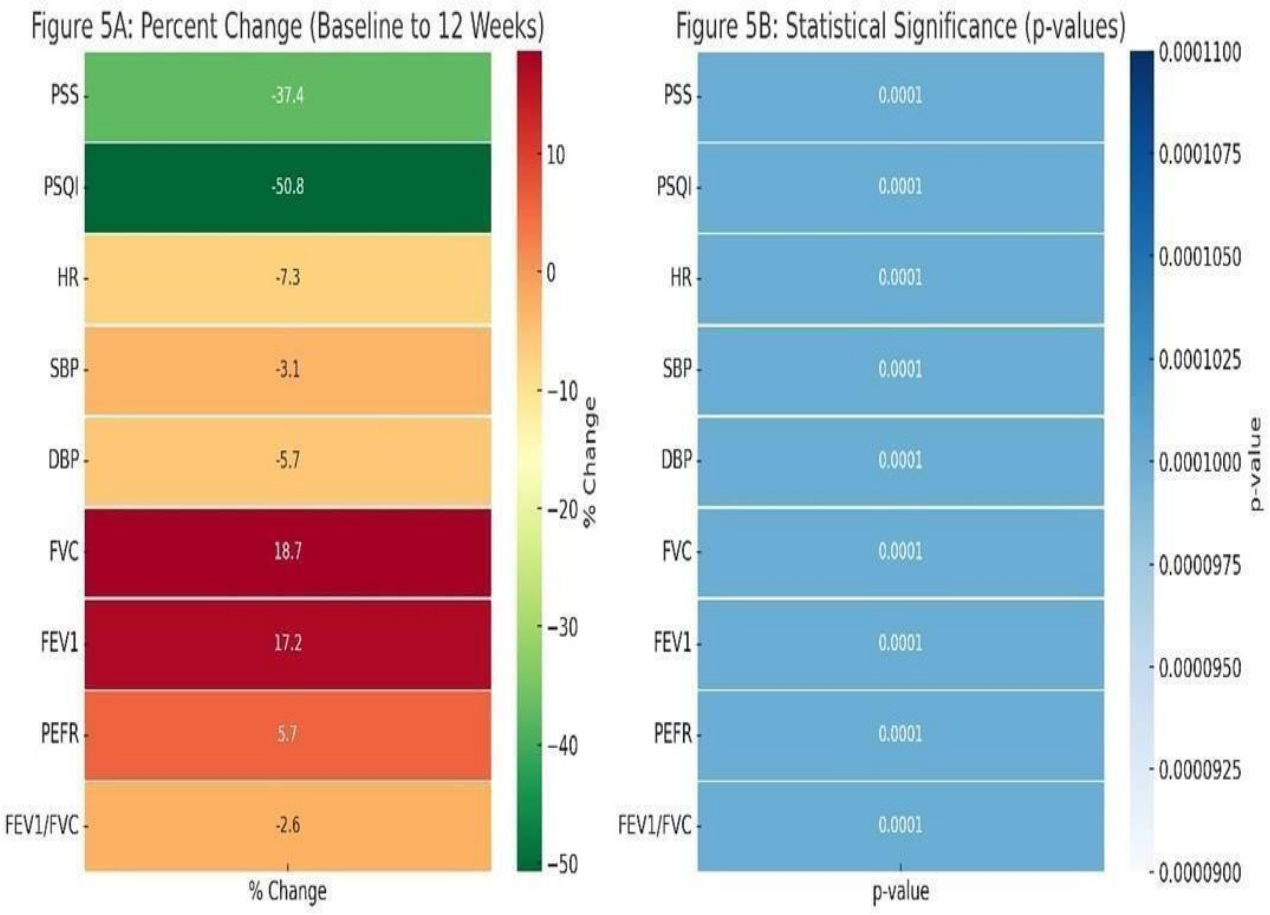


Figure W (5A & 5B) displays dual heatmaps that quantify the magnitude of change and statistical significance across all measured parameters. The percent change heatmap contextualizes the improvements in each metric, while the p-value heatmap confirms the robustness of these findings. Together, they underscore the validity and relevance of the intervention, supporting the discussion's claim of clinically meaningful improvements with high statistical confidence ($p < 0.0001$ across all domains).

The Panel A shows percent change in each parameter from baseline to 12 weeks. Panel B shows the statistical significance (p-values), with all values being highly significant ($p < 0.0001$). These heatmaps visually reinforce domain-specific improvements and statistical robustness. shown in Figure W: Heatmaps of Percent Change and p-values Across Domains



Summary of Statistical Findings

The statistical analysis conducted in this study strongly supports the hypothesis that integrated yoga and guided mantra meditation produce measurable and beneficial effects on both psychological and physiological parameters in young adults. Using a combination of parametric and non-parametric tests, we evaluated changes in perceived stress (PSS scores), sleep quality (PSQI scores), cardiovascular parameters (heart rate, SBP, DBP), and pulmonary function (FVC, FEV_1, PEFR) over a 12-week intervention period.

The repeated-measures design allowed for comprehensive intra-group comparisons across three time points—baseline, 6 weeks, and 12 weeks—thus capturing not only the magnitude of end-point changes but also the progressive trajectory of improvement. Statistically significant reductions were observed in PSS and PSQI scores, indicating a steady decline in psychological stress and enhancement of sleep quality. Similarly, heart rate and blood pressure values demonstrated significant downward trends, reflecting autonomic rebalancing and cardiovascular adaptation. Pulmonary function tests revealed incremental increases in FVC, FEV_1, and PEFR, underscoring the respiratory benefits of structured yogic breathing and postural exercises.

All key statistical comparisons, including mean differences, standard deviations, test statistics, and p-values, are summarized in Tables 1 to 5. The consistently significant p-values (<0.05) across multiple domains provide quantitative evidence of the multifaceted efficacy of the yoga and mantra meditation intervention. These findings collectively validate the study's core hypothesis, supporting the integration

of structured mind–body practices into preventive health and wellness programs.

The statistical outcomes of this study provide a coherent narrative that complements the physiological and psychological interpretations presented in the Discussion. The consistent decline in stress and sleep disturbance scores, coupled with gradual improvements in cardiovascular and pulmonary metrics, reflects the synergistic benefits of yoga asanas, pranayama, and mantra meditation. These findings substantiate the concept that mind–body interventions act through multiple pathways, including autonomic modulation, enhanced respiratory efficiency, and neuroendocrine balance. Moreover, the progressive nature of the changes across 6- and 12-week assessments underscores the cumulative effects of regular, structured practice. By aligning quantitative results with the physiological mechanisms discussed earlier, this analysis reinforces the study's conclusion that yoga and mantra meditation represent an effective, accessible, and low-cost strategy for promoting holistic well-being in young adults.

DISCUSSION

This study investigated the impact of a structured 12-week program combining yoga practices with mantra meditation on multiple physiological and psychological parameters, including perceived stress, sleep quality, cardiovascular indices, and pulmonary function, in 75 healthy young adults. Analysis of pre- and post-intervention data demonstrated significant and consistent improvements across all domains, highlighting the broad, integrative benefits of this mind-body intervention on overall psychophysiological well-being.

Psychological Domain

In the psychological domain, participants demonstrated a clear and progressive decline in both Perceived Stress Scale (PSS) and Pittsburgh Sleep Quality Index (PSQI) scores from baseline to the 6-week mark and further to 12 weeks. This pattern reflects the well-documented effects of yoga and meditation on mental relaxation and stress modulation. Regular engagement in yoga is known to influence the hypothalamic–pituitary–adrenal (HPA) axis and attenuate sympathetic overactivity, ultimately reducing circulating cortisol and mitigating perceived stress [63,64].

Mantra chanting, particularly the repetition of “OM,” has been linked to the synchronization of cortical and subcortical activity and modulation of limbic structures, such as the amygdala and hippocampus. These neurophysiological effects are thought to enhance emotional regulation and resilience to stress [65,66]. The present findings are consistent with prior studies by Telles et al. and Streeter et al., which reported meditation-driven reductions in stress accompanied by improved parasympathetic tone [67,68].

The observed improvements in PSQI scores indicate better sleep initiation, continuity, and subjective quality. Pranayama techniques, by enhancing vagal modulation and baroreflex sensitivity, likely promote higher melatonin secretion and a more synchronized circadian rhythm [69,70]. Collectively, these outcomes suggest that regular yoga and mantra meditation not only reduce psychological arousal but also facilitate deeper and restorative stages of sleep.

Cardiovascular Domain

In the cardiovascular domain, the 12-week intervention produced clear reductions in heart rate, systolic blood pressure (SBP), and diastolic blood pressure (DBP). These improvements reflect autonomic recalibration, often attributed to yoga practice, wherein sympathetic overactivity is dampened and parasympathetic dominance is enhanced [71]. The breathing regulation and meditative components of the sessions likely activated central autonomic networks through afferent vagal pathways, contributing to a more stable cardiovascular profile [72].

The physiological changes observed may also involve a downregulation of the renin-angiotensin system, reduced peripheral vascular resistance, and enhanced baroreceptor sensitivity [73,74]. Such mechanisms collectively improve hemodynamic stability and reduce cardiovascular strain. The findings resonate with the work of Pal et al. [75], who demonstrated similar declines in blood pressure and heart rate in yoga practitioners. Furthermore, integrating mantra meditation may provide additional cardioprotective effects by lowering catecholamine release and promoting emotional balance, further mitigating cardiovascular risk [76,77].

Pulmonary Domain

In the pulmonary domain, the intervention produced statistically significant enhancements in all measured parameters, including Forced Vital Capacity (FVC), Forced Expiratory Volume in the first second (FEV1), Peak Expiratory Flow Rate (PEFR), and the FEV1/FVC ratio. These improvements are consistent with prior evidence supporting yoga as a modality for optimizing respiratory mechanics. The pranayama practices incorporated in the program likely promoted thoracoabdominal coordination, improved lung compliance, and strengthened respiratory musculature [78,79].

Slow and deep breathing patterns used in the sessions may have facilitated greater alveolar recruitment, reduced airway resistance, and consequently enhanced vital capacity [80]. These findings echo the observations of Kulkarni et al. and Joshi et al., who reported that yoga practitioners exhibit superior pulmonary function test (PFT) performance, largely attributed to sustained respiratory effort and breath-holding techniques inherent to yogic practice [81,82]. The progressive improvements documented across baseline, 6-week, and 12-week assessments further indicate that these effects are cumulative and consolidative rather than transient.

Overall Implications

The findings of this study highlight the comprehensive psychophysiological benefits of an integrated yoga and mantra meditation regimen. Consistent and structured practice led to a concurrent reduction in perceived stress and improvement in sleep quality, accompanied by favorable shifts in autonomic balance and pulmonary function. These multidimensional outcomes emphasize the capacity of yoga-based interventions to modulate both mental and physiological health markers in young adults.

Although cardiovascular parameters were incorporated as a post hoc addition, their patterns of improvement are congruent with well-established autonomic and hemodynamic mechanisms documented in earlier research. This coherence reinforces the reliability of the observed effects.

For future work, extending these observations with biochemical profiling (e.g., cortisol levels, pro- and anti-inflammatory markers such as IL-6), neuroimaging techniques, and long-term follow-up assessments could provide deeper insight into the mechanistic pathways and durability of these psychophysiological adaptations. Such multi-modal evidence would strengthen the role of yoga and mantra meditation as adjunctive interventions for health optimization and stress resilience in young populations.

Limitations and Future Directions

Despite the promising findings, several limitations must be acknowledged. First, the study did not include a control group, which restricts the ability to isolate the intervention's effects from potential confounding factors such as natural variability in stress or sleep patterns over time. Second, gender stratification and body composition analysis were not performed, which could have provided insights into sex-specific physiological responses to yoga and meditation. Third, while the sample size of 75 participants was adequate for preliminary statistical significance, larger, multi-center trials would enhance generalizability. Fourth, the study relied primarily on questionnaire-based psychometric assessments and spirometry; the inclusion of biochemical markers (such as serum cortisol, melatonin, and inflammatory cytokines) and neurophysiological measures (like EEG or HRV spectral analysis) in future research could provide mechanistic depth.

Future studies should adopt randomized controlled trial designs with longer follow-up periods to assess the sustainability of observed benefits. Incorporating diverse age groups, lifestyle patterns, and baseline stress profiles can provide a more comprehensive understanding of the intervention's applicability in broader populations. Additionally, exploring the integration of yoga and mantra meditation into institutional wellness programs and its impact on academic performance, mental resilience, and long-term cardiopulmonary health would strengthen the evidence base for large-scale adoption in public health initiatives.

CONCLUSION

This study demonstrates compelling evidence that a systematic 12-week program of yoga and mantra meditation can induce multidimensional improvements in the psychological and physiological well-being of young adults. Through a combination of structured yoga postures, guided pranayama, and mantra chanting, participants experienced progressive and sustained reductions in perceived stress levels alongside marked enhancements in sleep quality. These findings reflect the neurophysiological benefits of mind–body practices, which likely act through modulation of the hypothalamic–pituitary–adrenal (HPA) axis, enhancement of vagal tone, and attenuation of sympathetic hyperactivity, ultimately fostering a more resilient stress response and restorative sleep cycles.

From a physiological perspective, the intervention elicited notable improvements in autonomic and respiratory functions. The reductions in heart rate, systolic, and diastolic blood pressure indicate enhanced autonomic balance, consistent with prior evidence supporting yoga as a non-pharmacological approach for cardiovascular regulation. These effects are plausibly mediated through parasympathetic activation, reduced catecholamine release, and improved baroreceptor sensitivity, collectively contributing to cardiovascular homeostasis. The significant gains in pulmonary function—including increased FVC, FEV_1, and PEFR—underscore the respiratory conditioning effects of pranayama and yogic breathing techniques, which promote thoracoabdominal coordination, alveolar recruitment, and respiratory muscle strengthening.

Importantly, although cardiovascular parameters were analyzed post hoc, their consistent improvements enrich our understanding of the systemic physiological adaptations induced by integrated yoga-meditation programs. Together, these

outcomes support the holistic benefits of mind–body interventions, where mental well-being and physiological health are intrinsically linked.

Despite these promising findings, certain methodological limitations warrant cautious interpretation. The absence of a randomized control group, lack of gender-stratified analysis, and restriction to a single institutional cohort may limit the generalizability of results. Nonetheless, the longitudinal design, validated assessment tools, and robust internal comparisons across three time points provide strong internal validity and support the observed effects.

Looking forward, future research should adopt randomized controlled trial (RCT) designs with larger and more diverse populations, incorporate biochemical markers of stress and inflammation, and assess long-term adherence and sustainability of benefits. Inclusion of neurophysiological assessments such as EEG or functional imaging could further elucidate the mechanistic underpinnings of mantra meditation and yogic breathing on brain–body connectivity.

In conclusion, this study affirms that regular guided practice of yoga and mantra meditation can serve as an accessible, non-pharmacological, and cost-effective strategy for promoting mental well-being, autonomic balance, and respiratory health in young adults. Such interventions hold considerable potential for integration into student wellness programs, institutional health initiatives, and preventive healthcare frameworks, contributing to the broader vision of holistic and sustainable public health.

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ANNEXURES

1. Pittsburgh Sleep Quality Index (PSQI)

2. Perceived Stress scale (PSS)

3. PFT Inform Consent

4. A- Offline Yoga And Meditation Sessions
   B - Online Yoga And Meditation Sessions
   C – PFT Machine - Clearity – Spirotech
   D – Performing PFT

ANNEXURE 1

The Pittsburgh Sleep Quality Index (PSQI)

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions. During the past month,

1. When have you usually gone to bed? _____
2. How long (in minutes) has it taken you to fall asleep each night? _____
3. When have you usually gotten up in the morning? _____
4. How many hours of actual sleep do you get at night? (This may be different than the number of hours you spend in bed) _____

5. During the past month, how often have you had trouble sleeping because you…	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times week (3)
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe, including how often you have had trouble sleeping because of this reason(s):				
6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad (3)
9. During the past month, how would you rate your sleep quality overall?				

Component 1	#9 Score	C1_____
Component 2	#2 Score (≤15min=0; 16-30 min=1; 31-60 min=2, >60 min=3) + #5a Score (If sum is equal 0=0; 1-2=1; 3-4=2; 5-6=3)	C2_____
Component 3	#4 Score (>7=0; 6-7=1; 5-6=2; <5=3)	C3_____
Component 4	(total # of hours asleep)/(total # of hours in bed) x 100 >85%=0, 75%-84%=1, 65%-74%=2, <65%=3	C4_____
Component 5	Sum of Scores #5b to #5j (0=0; 1-9=1; 10-18=2; 19-27=3)	C5_____
Component 6	#6 Score	C6_____
Component 7	#7 Score + #8 Score (0=0; 1-2=1; 3-4=2; 5-6=3)	C7_____

Add the seven component scores together _____ **Global PSQI Score** _____

Buysse, D.J., Reynolds III, C.F., Monk, T.H., Berman, S.R., & Kupfer, D.J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Journal of Psychiatric Research, 28*(2), 193-213.

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ANNEXURE 2

Perceived Stress Scale

Name:	Date:

The Perceived Stress Scale can be used to determine a more precise measure of personal stress. The Perceived Stress Scale (PSS) is a well-known stress assessment tool. The tool is popular for assisting us in understanding how various situations affect our feelings and perceived stress. The questions on this scale ask about your feelings and thoughts over the previous month. In each situation, you will be asked how frequently you felt or thought a certain way.

For each question choose from the following alternatives:

0 - Never **1 - Almost Never** **2 - Sometimes** **3 - Fairly Often** **4 - Very Often**

Questions	Rating
1. In the last month, how often have you been upset because of something that happened unexpectedly?	
2. In the last month, how often have you felt that you were unable to control the important things in your life?	
3. In the last month, how often have you felt nervous and stressed?	
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	
5. In the last month, how often have you felt that things were going your way?	
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	
7. In the last month, how often have you been able to control irritations in your life?	
8. In the last month, how often have you felt that you were on top of things?	
9. In the last month, how often have you been angered because of things that happened that were outside of your control?	
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	

Calculating Your PSS Score

1. First, reverse your scores for questions 4, 5, 7, and 8. On these 4 questions, change the scores like this:

0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0

2. Add up your scores for each item to get a total. My total score is _____.

3. Your individual score on the PSS can range from 0 to 40 with higher scores indicating higher perceived stress.

- Scores ranging from **0-13** would be considered **low stress**.
- Scores ranging from **14-26** would be considered **moderate stress**.
- Scores ranging from **27-40** would be considered **high perceived stress.**

The results of the following self-assessment do not reflect any specific diagnosis or treatment plan. They are intended to be used as a tool to help you assess your level of stress. If you have any additional concerns about your current state of health, please seek the help of specialists.

ANNEXURE 3

PFT consent form

Referral Date: _____

Booking Priority: ☐ASAF: ☐ Next available
☐Book In_____

Referring Physician: _____
(please print)

Reason for Referral: _____

Existing blagnosis: _____

High lavel (done within past 3 mos.): _____

Completed fo be s be taxed to NYH Lab 306-378-8312

Pattent Name: _____

Telephone #: _____

Health Card #: _____ VC_____

DOB & Age: _____ Height & Weight: _____

Address: _____

PATIENT HISTORY

Non smoker	☐ Yes	☐ No
Former smoker	☐ Yes	☐ No
Pack Years _____		
Present smoker	☐ Yes	☐ No
Pack Years _____		

Does the patient have a history of:

Aathvia	☐ Yes	☐ No
Emphysema	☐ Yes	☐ No
Branchitts	☐ Yes	☐ No
Pnesimonia	☐ Yes	☐ No
Restrictive Lung Disease	☐ Yes	☐ No
Interastial Lung Oisease:fi brosis	☐ Yes	☐ No

Other pulmonary disorders _____

_____

Cardlac disease	☐ Yes	☐ No
(Possible) (F or other infectious diseases	☐ Yes	☐ No
Suc surgen) in the past 2 weeks	☐ Yes	☐ No
Previous PFTs performed	☐ Yes	☐ No

Where? _____

Where? _____

Recent chost x ray	☐ Yes	☐ No
Recent ECHO	☐ Yes	☐ No
Recent cardiac stress test	☐ Yes	☐ No
Currently using Onygen	☐ Yes	☐ No

MEDICATIONS

(bronchooliators/anti-inflammatories/oxygen **only)**

_____

_____

_____

TESTING REQUIRED

1. **Complete Pulnanary Function Study** ☐
   (Includes ale: are 1 post post braxhooiiator, lang function capority, lung volumes, res ring sfjuine
2. **Pre/Fost Bronchillator Sipsimetry** ☐
3. **Lung Yolumes & Alrway Resistemetry** ☐
4. **Diflusion Capacity and Transfer Factor** ☐
5. **Arterial Blood Gases** ☐
   ☐For room air ☐On O_2_____LPM
6. **Home Onygen Assessment:** ☐
   (Includes testing and exrrönal oximetry with oxygen, it required, and/or arterial blood goses on gr)
   ☐For initial O_2 funding
   ☐For O_2 funding re qualification
   Funding Benewal Date: _____
7. 6 **Minute Walk-Test** ☐
   ☐On room air ☐On O_2_____LPM

_____
Physiclan Signature

_____
Fax Number

ANNEXURE 4

A- Offline yoga and meditation sessions

B-Online yoga and meditation sessions

C- Clearity - Spirotech for PFT

D - Performing - PFT

PROFORMA

(Details of patient to be included)

Pattent Name: _____

Telephone #: _____

Health Card #: _____ VC _____

DOB & Age: _____ Height & Weight: _____

Address: _____

Patient Name: Ayush

Telephone #: 81785455....

Health Card #: _____ VC _____

DOB & Age: 12/10/2002 Height & Weight: 5.9 kg

Address: Crossing republic Ghaziabad

SANTOSH DEEMED TO BE UNIVERSITY (GHAZIABAD)

INFORMED CONSENT ENGISH

INFORMED CONSENT FORM

Title of the thesis: Impact of Guided Mantra Meditation and Yoga Asanas on Pulmonary Function, Sleep Quality and Stress level in Young Adults with Mild Sleep Disturbances

Name of the Investigator: Ms Gauri Mudgal

I have been explained to my full understanding in detail the nature and purpose of the above study, its potential risks/ benefits and other details. I participate in the study voluntarily and I am free to withdraw from it at any time without giving any reason. I also understand that information collected from this study will be kept confidential.

Name of the participant:

Date: Place:

Signature of the participant:

Name and signature of the person obtaining consent:

Date:

Witness name and signature

……..

Address

Date: Place:

SANTOSH DEEMED TO BE UNIVERSITY (GHAZIABAD)

INFORMED CONSENT HINDI

सूचित सहमति प्रपत्र

प्रबंध का शीर्षक: निर्देशित मंत्र ध्यान और योग आसनों का फुफ्फुसीय क्रिया, नींद की गुणवत्ता और तनाव स्तर पर प्रभाव उन युवाओं में जिन्हें हल्की नींद की गड़बड़ियाँ हैं।

अन्वेषक का नाम: सुश्री गौरी मुद्गल

मुझे उपरोक्त अध्ययन की प्रकृति और उद्देश्य, संभावित जोखिम/लाभ और अन्य विवरणों के बारे में पूरी तरह से समझा दिया गया है। मैं स्वेच्छा से इस अध्ययन में भाग ले रहा/रही हूँ और बिना कोई कारण बताए किसी भी समय इससे बाहर निकल सकता/सकती हूँ। मैं यह भी समझता/समझती हूँ कि इस अध्ययन से एकत्र की गई जानकारी को गोपनीय रखा जाएगा।

प्रतिभागी का नाम:

तिथि: स्थान:

प्रतिभागी के हस्ताक्षर:

सहमति प्राप्त करने वाले व्यक्ति का नाम और हस्ताक्षर:

तिथि:

गवाह का नाम और हस्ताक्षर:

.....

पता:

तिथि: स्थान:

LETTER OF ETHICAL CLEARANCE FOR DISSERTATION

FROM REGISTRAR OFFICE

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Celebrating 30 Impactful years Since 1990

F. No. SU/2025/CRF/215 Dated: 25.05.2025

Subject: Approval of Research Project by the Institutional Human Ethics Committee.

Particular	Description
Project No.	EC/MSc Physiology/215
Project Title	Impact of Guided Mantra Meditation and Yoga Asanas on Pulmonary Function, Sleep Quality and stress level in Young Adults with Mild Sleep Disturbances
Student Name	Gauri Mudgal
Guide	Dr Manisha Gupta
Department	M.Sc. Medical Physiology
Institution Name	Santosh Medical College & Hospital, Ghaziabad
Type of Study	Prospective interventional longitudinal
Ethics Committee Decision	Approved

This Ethical clearance letter is valid for 2 years from the date of issue.

Dr. Jyoti Batra
Member Secretary

Santosh Deemed to be University Dean Research

To,

Gauri Mudgal,

Department of M.Sc. Medical Physiology

STATISTICIAN CERTIFICATE

This is to certify that the statistical analysis component of this thesis title "**Impact of Guided Mantra Meditation and Yoga Asanas on Pulmonary Function, Sleep Quality and Stress level in Young Adults with Mild Sleep Disturbances** " done by **Gauri Mudgal** in the department of physiology , Santosh medical college and hospital , Ghaziabad has been conducted under my guidance and Supervision.

All the statistical calculations of the study are authentic and correct to the best of my knowledge.

Wish her all the success in her life.

Dr. Kirti Bhardwaj, PhD

Biostatistician

Department of Central Research Facility

Santosh Deemed to be University, Ghaziabad-201009

PLAGIARISM CERTIFICATE

Gauri Mudgal

Impact of guided mantra meditation and yoga asanas on pulmonary function, sleep Quality and stress level in young adults with mild sleep disturbances

Santosh University, Ghaziabad

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MASTER CHART

			BASELINE (0 WEEKS)									YOGA	6 WEEKS AFTER YOGA							YOGA	12 WEEKS AFTER YOGA						
GENDER	HEIGHT	WEIGHT	PRE SLEEP	PRE STRESS	PRE YOGA HR	PRE YOGA BP		BEFORE YOGA BASELINE (PFT)					AFTER 6 WEEK SLEEP	AFTER 6 WEEK STRESS	AFTER 6 WEEK HR	AFTER 6 WEEK BP		AFTER 6 WEEKS PFT					AFTER 12 WEEK SLEEP	AFTER 12 WEEK STRESS	AFTER 12 WEEK HR	AFTER 12 WEEK BP		AFTER 12 WEEKS PFT			
						SBP	DBP	FVC	FEV1	PEFR	FEV1/FVC RATIO																		
F	160cm	79kg	10	24	78bpm	122mmhg	78mmhg	2.32	2.18	4.7	93.98		9	22	77bpm	120mmhg	76mmhg	2.46	2.21	5.2	89.83%		8	20	71bpm	116mmhg	74mmhg	2.98	2.17	4.37	79.69
F	158cm	74kg	6	12	72bpm	128mmhg	82mmhg	2.11	2.09	4.61	99.26		5	11	70bpm	126mmhg	80mmhg	2.55	2.23	4.98	87.45%		5	10	68bpm	122mmhg	76mmhg	2.38	2.27	4.68	95.41
M	168cm	61kg	7	19	82bpm	120mmhg	76mmhg	2.78	2.56	5.5	92.17		6	17	80bpm	118mmhg	74mmhg	2.89	2.75	5.98	95.15%		6	16	72bpm	114 mmhg	72 mmhg	3.96	3.5	6.14	88.34
M	175cm	75kg	7	16	92bpm	130mmhg	78mmhg	3.83	3.81	5.18	99.6		6	15	90bpm	128mmhg	76mmhg	3.89	3.84	5.18	98.71%		5	15	80bpm	124mmhg	74mmhg	4.93	4.37	6.26	88.76
M	170cm	76kg	5	24	72bpm	134mmhg	74mmhg	2.44	2.43	7.91	99.37		5	22	70bpm	130mmhg	72mmhg	2.78	2.55	7.98	91.72%		3	23	68bpm	128mmhg	70 mmhg	3.54	3.51	6.92	99.1
M	187cm	81kg	6	26	82bpm	126mmhg	76mmhg	3.16	3.14	4.55	99.51		5	24	80bpm	122mmhg	76mmhg	3.78	3.25	4.87	85.97		4	21	75bpm	120mmhg	74 mmhg	5.07	4.26	5.11	83.87
M	165cm	86kg	5	21	73bpm	132mmhg	78mmhg	2.97	2.95	5.8	99.48		4	20	72bpm	130mmhg	76mmhg	3.1	2.95	5.98	95.16%		3	18	65bpm	126mmhg	74 mmhg	4.39	4.37	7.6	99.65
M	180cm	60kg	4	18	70bpm	118mmhg	74mmhg	3.07	3.05	5.62	99.5		4	17	69bpm	116mmhg	72mmhg	3.19	3.09	5.97	96.86%		3	12	65bpm	114mmhg	72 mmhg	3.08	3.06	6.39	99.5
F	162cm	59kg	4	16	78bpm	128mmhg	76mmhg	3.28	2.93	4.95	89.52		4	15	76bpm	126mmhg	74mmhg	3.43	3.36	5.09	97.95%		3	14	71bpm	122mmhg	72 mmhg	3.44	3.21	3.85	93.5
F	158cm	65kg	8	22	85bpm	134mmhg	80mmhg	3.14	2.69	3.26	85.63		7	20	83bpm	132mmhg	78mmhg	3.26	3.19	3.97	97.85%		6	20	78bpm	128mmhg	74 mmhg	2.63	2.52	4.23	95.85
F	155cm	50kg	7	18	81bpm	116mmhg	76mmhg	2.15	2.14	3.9	99.27		6	17	80bpm	114mmhg	74mmhg	2.25	2.23	4.03	99.11%		4	15	73bpm	114mmhg	72 mmhg	2.77	2.66	4.34	96.05
F	164cm	60kg	6	14	79bpm	118mmhg	82mmhg	2.24	2.22	4.85	98.61		6	13	78bpm	116mmhg	80mmhg	2.37	2.29	4.98	96.66%		5	12	73bpm	114mmhg	76 mmhg	2.31	2.27	5.01	95.96
F	167cm	73kg	6	23	83bpm	122mmhg	84mmhg	3.48	3.22	3.65	92.52		6	22	82bpm	120mmhg	82mmhg	3.59	3.38	3.67	94.15%		5	22	78bpm	116mmhg	78 mmhg	2.82	2.75	5.92	97.78
F	163cm	58kg	8	13	71bpm	124mmhg	74mmhg	2.1	2.08	3.37	99.25		7	12	70bpm	122mmhg	72mmhg	2.24	2.2	3.76	98.21%		6	12	67bpm	118mmhg	74 mmhg	2.34	2.32	4.19	99.33
F	160cm	65kg	9	24	78bpm	128mmhg	82mmhg	3.27	3.24	6.61	99.05		8	23	77bpm	126mmhg	80mmhg	3.35	3.28	6.84	97.91%		7	20	73bpm	120 mmhg	72 mmhg	4.21	4.2	5.72	99.64
F	160cm	62kg	5	18	86bpm	116mmhg	76mmhg	1.58	1.57	3.4	99.02		5	17	84bpm	114mmhg	74mmhg	1.79	1.68	3.65	93.85%		4	16	80bpm	114mmhg	70 mmhg	2.38	2.37	4.92	99.57
F	161cm	51kg	5	18	81bpm	128mmhg	84mmhg	1.31	1.3	3.17	98.89		5	17	80bpm	126mmhg	82mmhg	1.67	1.53	4.12	91.61%		5	17	69bpm	120 mmhg	76 mmhg	2.2	2.1	3.92	95.45
M	183cm	87kg	6	20	74bpm	116mmhg	78mmhg	4.06	4.05	10.27	99.62		6	19	72bpm	114mmhg	76mmhg	4.67	4.09	10.12	87.58%		5	20	69bpm	114 mmhg	72 mmhg	4.92	4.6	9.27	93.49
M	190cm	76kg	3	13	83bpm	118mmhg	76mmhg	3.71	3.69	8.33	99.58		3	11	82bpm	116mmhg	74mmhg	3.89	3.45	8.01	88.68%		3	11	75bpm	116mmhg	70 mmhg	4.12	3.97	8.27	96.35
M	178cm	75kg	6	22	81bpm	124mmhg	82mmhg	2.92	2.9	9.11	99.47		5	20	80bpm	120mmhg	80mmhg	2.98	2.92	9.45	97.98%		6	20	74bpm	120mmhg	74 mmhg	3.56	3.35	9.76	94.1
M	183cm	53kg	8	13	91bpm	128mmhg	86mmhg	3.67	3.65	7.97	99.58		7	11	88bpm	126mmhg	84mmhg	3.89	3.69	7.89	94.85%		7	12	83bpm	120mmhg	80 mmhg	3.97	3.89	6.76	97.98
M	185cm	92kg	6	10	82bpm	120mmhg	78mmhg	2.5	2.48	4.92	99.38		5	9	80bpm	118mmhg	74mmhg	2.68	2.59	5.04	96.64%		4	7	78bpm	116mmhg	72 mmhg	2.85	2.71	4.93	95.08
F	170cm	81kg	5	28	73bpm	116mmhg	78mmhg	3.26	3.07	3.93	94.27		5	26	70bpm	114mmhg	74mmhg	3.45	3.13	4.23	90.72%		4	24	68bpm	114mmhg	74 mmhg	2.94	2.77	4.4	94.14
F	162cm	52kg	8	27	78bpm	124mmhg	84mmhg	2.39	2.38	4.4	99.35		7	25	76bpm	122mmhg	82mmhg	2.46	2.31	4.67	93.90%		8	25	74bpm	120 mmhg	78 mmhg	2.65	2.2	2.59	83.03
M	167cm	64kg	11	28	85bpm	126mmhg	86mmhg	3.38	2.67	3.94	79.03		10	26	80bpm	124mmhg	84mmhg	3.98	2.74	4.44	86.16%		9	23	80bpm	120mmhg	80 mmhg	4.16	3.21	4.61	77.2
M	178cm	85kg	4	19	74bpm	118mmhg	78mmhg	3.07	2.92	4.81	95.01		4	18	72bpm	116mmhg	76mmhg	3.18	2.96	5.04	93.08%		4	17	69bpm	116mmhg	74 mmhg	3.49	2.93	5.49	84.1
F	160cm	80kg	11	32	79bpm	116mmhg	76mmhg	2.6	2.43	5.11	93.42		10	30	78bpm	116mmhg	74mmhg	2.91	2.58	5.67	88.65%		8	27	71bpm	114mmhg	72 mmhg	2.59	2.21	3.91	85.54
F	160cm	57kg	13	30	81bpm	132mmhg	86mmhg	2.82	2.74	4.71	98.9		12	27	80bpm	130mmhg	84mmhg	2.89	2.85	5.12	98.61%		10	26	75bpm	128mmhg	82 mmhg	2.69	2.61	4.18	97.09
F	162cm	57kg	8	21	76bpm	126mmhg	88mmhg	2.61	2.59	3.94	99.4		7	18	75bpm	126mmhg	86mmhg	2.86	2.69	4.03	94.05%		6	17	70bpm	122mmhg	80 mmhg	2.85	2.73	5.91	95.62
M	172cm	69kg	2	15	79bpm	118mmhg	76mmhg	3.08	3.06	4.51	99.5		2	14	78bpm	118mmhg	84mmhg	3.23	3.17	5.03	97.21%		2	12	72bpm	114mmhg	74 mmhg	3.69	3.12	3.49	84.68
M	164cm	54cm	3	15	72bpm	130mmhg	88mmhg	2.93	2.91	6.58	99.47		2	13	70bpm	128mmhg	74mmhg	3.16	3.08	7.84	97.46%		3	10	67bpm	124mmhg	82 mmhg	2.92	2.91	5.42	99.47
M	172cm	77kg	5	6	79bpm	116mmhg	76mmhg	3.08	3.07	5.94	99.5		4	4	78bpm	116mmhg	74mmhg	3.1	2.95	6.22	95.16%		4	5	71bpm	116mmhg	72 mmhg	3.23	3.16	6.84	98.07
M	178cm	72kg	7	19	85bpm	124mmhg	84mmhg	3.93	3.89	4.96	99.2		6	16	83bpm	124mmhg	80mmhg	3.98	3.89	4.99	97.73%		6	17	78bpm	120mmhg	80 mmhg	4.19	4.16	6.52	99.25
F	158cm	52kg	5	10	79bpm	118mmhg	72mmhg	2.88	2.43	3.27	84.44		5	8	80bpm	118mmhg	70mmhg	2.98	2.68	3.78	89.93%		4	8	72bpm	116mmhg	70 mmhg	2.82	2.39	3.23	84.68
M	189cm	101kg	2	17	91bpm	132mmhg	84mmhg	2.87	2.57	5.76	89.65		2	15	90bpm	132mmhg	80mmhg	2.97	2.67	6.03	89.89%		2	16	86bpm	126mmhg	80 mmhg	2.87	2.68	5.69	93.48
M	172cm	70kg	4	18	74bpm	118mmhg	74mmhg	2.05	2.51	4.03	94.72		4	14	72bpm	118mmhg	72mmhg	2.67	2.58	4.23	96.62%		4	16	70bpm	116mmhg	70 mmhg	2.91	2.83	4.26	97.25
F	156cm	53kg	11	28	79bpm	122mmhg	84mmhg	2.02	2	3.78	99.23		10	26	78bpm	122mmhg	80mmhg	2.34	2.03	3.89	86.75%		10	25	71bpm	120mmhg	78 mmhg	2.73	2.25	4.47	84.3
F	156cm	57kg	7	27	76bpm	116mmhg	78mmhg	1.87	1.85	3.51	99.16		6	25	74bpm	116mmhg	74mmhg	2.01	1.98	4.75	98.50%		6	24	69bpm	114mmhg	72 mmhg	3.28	2.76	4.47	84.3
F	166cm	65kg	5	30	82bpm	114mmhg	74mmhg	2.55	2.39	4.41	93.9		4	28	80bpm	114mmhg	72mmhg	2.68	2.58	4.79	96.26%		4	26	79bpm	114 mmhg	74 mmhg	4.81	4.8	5.73	99.67
F	168cm	80kg	11	33	71bpm	124mmhg	76mmhg	3.03	3.01	5.88	99.49		10	30	70bpm	124mmhg	78mmhg	3.7	3.65	6.11	98.64%		9	29	67bpm	120mmhg	76 mmhg	4.35	3.65	4.83	84.88
F	164cm	67kg	4	27	86bpm	128mmhg	86mmhg	2.04	2.03	3.51	99.23		4	25	85bpm	126mmhg	84mmhg	2.54	2.24	4.32	88.18%		4	26	82bpm	122mmhg	82 mmhg	2.89	2.63	3.92	91.01
F	156cm	57kg	7	27	81bpm	124mmhg	80mmhg	2.77	2.29	2.85	82.77		6	25	80bpm	124mmhg	78mmhg	2.89	2.37	3.21	82.00%		7	24	74bpm	120mmhg	74 mmhg	2.92	2.91	5.42	99.47
F	170cm	59kg	5	25	84bpm	118mmhg	78mmhg	2.19	2.17	4.76	99.28		4	23	82bpm	116mmhg	74mmhg	2.34	2.22	5.21	94.87%		4	23	78bpm	116mmhg	74 mmhg	2.38	2.21	3.68	92.78
M	178cm	65kg	5	25	71bpm	124mmhg	74mmhg	3.26	3.23	5.37	99.53		4	21	70bpm	122mmhg	72mmhg	3.45	3.38	5.23	97.97%		5	22	68bpm	120 mmhg	70 mmhg	3.4	3.38	6.31	99.55
M	170cm	64kg	7	19	78bpm	126mmhg	78mmhg	2.79	2.77	5.93	99.44		6	17	76bpm	124mmhg	76mmhg	2.87	2.83	6.12	98.60%		6	18	74bpm	124mmhg	72 mmhg	4.02	4.01	8.11	99.62
M	154cm	54kg	7	21	81bpm	122mmhg	86mmhg	1.99	1.97	5.45	99.23		6	20	80bpm	120mmhg	84mmhg	2.09	2.03	6.12	97.12%		7	20	76bpm	120 mmhg	82 mmhg	2.22	2.2	5.69	99.3
M	162cm	58kg	6	20	86bpm	130mmhg	74mmhg	2.84	2.82	5.52	99.46		5	18	84bpm	128mmhg	72mmhg	2.97	2.95	7.23	99.32%		5	17	80bpm	126mmhg	72 mmhg	1.65	1.64	3.51	99.6
M	170cm	73kg	10	20	78bpm	124mmhg	84mmhg	2.06	1.86	3.39	90.13		9	18	76bpm	124mmhg	80mmhg	2.29	1.98	4.21	86.46%		8	18	74bpm	120mmhg	76 mmhg	3.29	2.83	5.38	86.24
M	170cm	57kg	7	17	83bpm	126mmhg	76mmhg	2.14	1.97	3.19	90.11		6	15	82bpm	124mmhg	74mmhg	2.65	2.06	4.54	77.73%		6	13	78bpm	122mmhg	72 mmhg	2.46	2.21	3.51	89.83
M	190cm	140kg	5	12	74bpm	120mmhg	80mmhg	4.16	3.5	3.76	84.43		4	10	72bpm	120mmhg	78mmhg	4.26	3.87	4.23	90.84%		4	9	70bpm	116mmhg	78 mmhg	4.11	3.93	6.66	95.57
M	180cm	112kg	7	20	76bpm	126mmhg	84mmhg	4.24	4.22	5.53	99.63		6	15	74bpm	124mmhg	82mmhg	4.56	4.37	6.67	95.83%		6	20	72bpm	122mmhg	82 mmhg	6.07	4.24	5.89	69.83
M	170cm	58kg	6	16	75bpm	118mmhg	78mmhg	3	2.89	4.2	96.38		5	14	74bpm	116mmhg	76mmhg	3.07	2.9	5.32	68.07%		6	15	71bpm	118mmhg	72 mmhg	3.32	2.95	4.86	88.85
F	160cm	58kg	7	22	71bpm	120mmhg	80mmhg	2.87	2.1	2.26	73.17		6	20	70bpm	120mmhg	78mmhg	2.89	2.35	3.45	81.31%		7	20	68bpm	116mmhg	76 mmhg	3.11	2.74	4.05	87.97
F	160cm	60kg	13	26	83bpm	132mmhg	86mmhg	2.64	2	2.36	75.7		12	24	80bpm	130mmhg	84mmhg	2.78	2.09	4.32	75.17%		10	23	76bpm	126mmhg	78 mmhg	3.97	3.95	4.23	99.61
F	156cm	43kg	2	20	78bpm	124mmhg	84mmhg	2.05	2.03	4.29	99.24		2	18	76bpm	122mmhg	82mmhg	2.45	2.08	6.55	84.89%		2	17	73bpm	120mmhg	76 mmhg	2.67	2.66	5.69	99.41
M	180cm	54kg	1	1	88bpm	128mmhg	88mmhg	2.21	2.19	6.65	99.3		1	1	86bpm	126mmhg	86mmhg	2.61	2.27	7.45	86.97%		1	1	81bpm	124mmhg	82 mmhg	3.46	3.44	7.26	99.95
M	185cm	70kg	13	20	81bpm	130mmhg	86mmhg	3.66	3.64	7.84	99.57		12	12	80bpm	128mmhg	84mmhg	3.98	3.65	8.43	91.70%		12	19	75bpm	126 mmhg	84 mmhg	4.8	9.78	5.06	99.68
F	164cm	43kg	5	22	82bpm	128mmhg	82mmhg	2.01	1.95	3.8	96.89		4	4	80bpm	126mmhg	80mmhg	2.79	2.56	4.78	91.75%		5	20	78bpm	124mmhg	78 mmhg	2.24	2.22	2.47	99.3
F	153cm	45kg	10	26	78bpm	122mmhg	80mmhg	2.02	2.01	3.52	99.22		9	8	76bpm	120mmhg	78mmhg	2.47	2.23	4.76	90.28%		10	24	71bpm	120mmhg	76 mmhg	2.08	2.02	2.83	97
F	153cm	50kg	8	24	73bpm	118mmhg	78mmhg	2.17	2.15	3.81	99.28		7	6	72bpm	116mmhg	76mmhg	2.26	2.24	4.87	99.11%		7	21	68bpm	116mmhg	74 mmhg	2.36	2.22	4.38	94.03
F	153cm	50kg	5	20	83bpm	126mmhg	76mmhg	1.99	1.97	3.89	99.22		5	5	80bpm	124mmhg	74mmhg	2.45	2.31	4.43	94.28%		4	19	78bpm	124mmhg	74 mmhg	2.56	2.38	4.23	93.26
F	146cm	55kg	5	12	86bpm	128mmhg	88mmhg	1.53	1.51	3.69	98.98		5	5	85bpm	126mmhg	86mmhg	1.89	1.78	4.21	94.17%		4	10	81bpm	124 mmhg	82 mmhg	1.6	1.58	4.4	99.02
F	170cm	78kg	7	23	72bpm	118mmhg	84mmhg	3.2	3	3.35	93.78		6	6	70bpm	116mmhg	82mmhg	3.28	3.04	4.01	92.68%		6	22	66bpm	118 mmhg	76 mmhg	4.23	3.2	3.42	75.61
M	170cm	75kg	6	11	87bpm	126mmhg	82mmhg	2.49	2.47	4.34	99.37		5	5	86bpm	124mmhg	86mmhg	2.87	2.69	4.54	93.72%		6	8	82bpm	124 mmhg	78 mmhg	3.3	3.26	4.15	98.78
F	158cm	57kg	5	23	89bpm	130mmhg	88mmhg	2.79	2.17	2.71	77.8		5	4	86bpm	128mmhg	86mmhg	2.89	2.65	3.78	91.69%		4	21	84bpm	122mmhg	84 mmhg	2.97	2.63	3.21	88.55
M	180cm	72kg	0	11	74bpm	124mmhg	76mmhg	4	3.99	9.47	99.61		0	0	72bpm	122mmhg	74mmhg	4.03	3.99	10.54	99.00%		0	8	70bpm	118mmhg	74 mmhg	4.25	4.19	9.58	98.58
M	173cm	75kg	6	23	71bpm	122mmhg	80mmhg	2.77	2.76	9.96	99.44		5	4	70bpm	120mmhg	78mmhg	2.98	2.85	10.04	95.63%		6	20	67bpm	120mmhg	78 mmhg	4.63	4.45	9.73	96.11
F	162cm	58kg	8	26	76bpm	126mmhg	82mmhg	1.66	1.64	3.62	99.06		7	5	74bpm	124mmhg	80mmhg	1.98	1.89	4.43	95.45%		7	23	72bpm	122mmhg	76 mmhg	1.93	1.89	3.71	97.92
F	155cm	46kg	6	27	72bpm	128mmhg	84mmhg	2.61	2.46	6.26	99.37		5	4	70bpm	126mmhg	82mmhg	2.98	2.76	7.34	92.61%		6	25	66bpm	122 mmhg	80 mmhg	2.7	2.59	4.29	95.93
F	168cm	58kg	7	23	76bpm	116mmhg	76mmhg	2.48	1.71	3.32	99.4		6	5	74bpm	114mmhg	74mmhg	2.68	1.89	4.45	70.52%		6	22	70bpm	116mmhg	70 mmhg	2.85	2.76	6.01	96.84
F	164cm	68kg	5	18	86bpm	126mmhg	78mmhg	1.88	2.59	4.47	90.84		5	4	84bpm	124mmhg	76mmhg	2.92	2.89	5.21	98.97%		5	17	81bpm	120mmhg	74 mmhg	2.63	2.44	4.4	92.89
F	153cm	48kg	7	24	77bpm	118mmhg	80mmhg	2.71	2.83	3.82	94.93		7	6	75bpm	116mmhg	78mmhg	2.94	2.78	4.43	94.55%		6	22	72bpm	116 mmhg	76 mmhg	2.7	2.26	4.2	83.85
F	164cm	65kg	10	24	72bpm	114mmhg	78mmhg	2.6	2.58	4.42	99.48		9	8	70bpm	112mmhg	74mmhg	2.89	2.68	5.12	92.73%		9	22	67bpm	114 mmhg	72 mmhg	2.91	2.8	4.65	96.21
F	162cm	85kg	8	29	73bpm	122mmhg	82mmhg	3.18	3.17	5.79	99.52		7	6	72bpm	120mmhg	80mmhg	3.28	3.27	5.89	99.69%		8	25	65bpm	120mmhg	80 mmhg	3.33	2.95	3.93	88.47
F	169cm	56kg	5	24	79bpm	124mmhg	82mmhg	3.18	3.11	4.79	97.79		5	4	76bpm	122mmhg	80mmhg	3.27	3.15	5.78	96.33%		5	20	73bpm	122 mmhg	78 mmhg	2.71	2.7	6.41	99.42